



THE
BOOKE
of
ARCHITECTURE
by
VINCENT SCAMOZZI
M^r Builder of Venice

LONDON
Printed for W^m Fisher





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THE *In: Division 1768*
Mirror of Architecture:
OR THE *pract. 286.*
GROUND-RULES
OF THE
Art of Building,

Exactly laid down by
VINCENT SCAMOZZI
Master-Builder of VENICE.

Reviewed and enlarged with the Addition of a Diagonal Scale
being very useful for dividing the Author his given Parts into Minutes,
whereby the principal Points of Architecture are easily and plainly
demonstrated for the Benefit of all Lovers and Ingenious Practiti-
oners in the said Art.

By *Joachim Schuym* of *Amsterdam.*

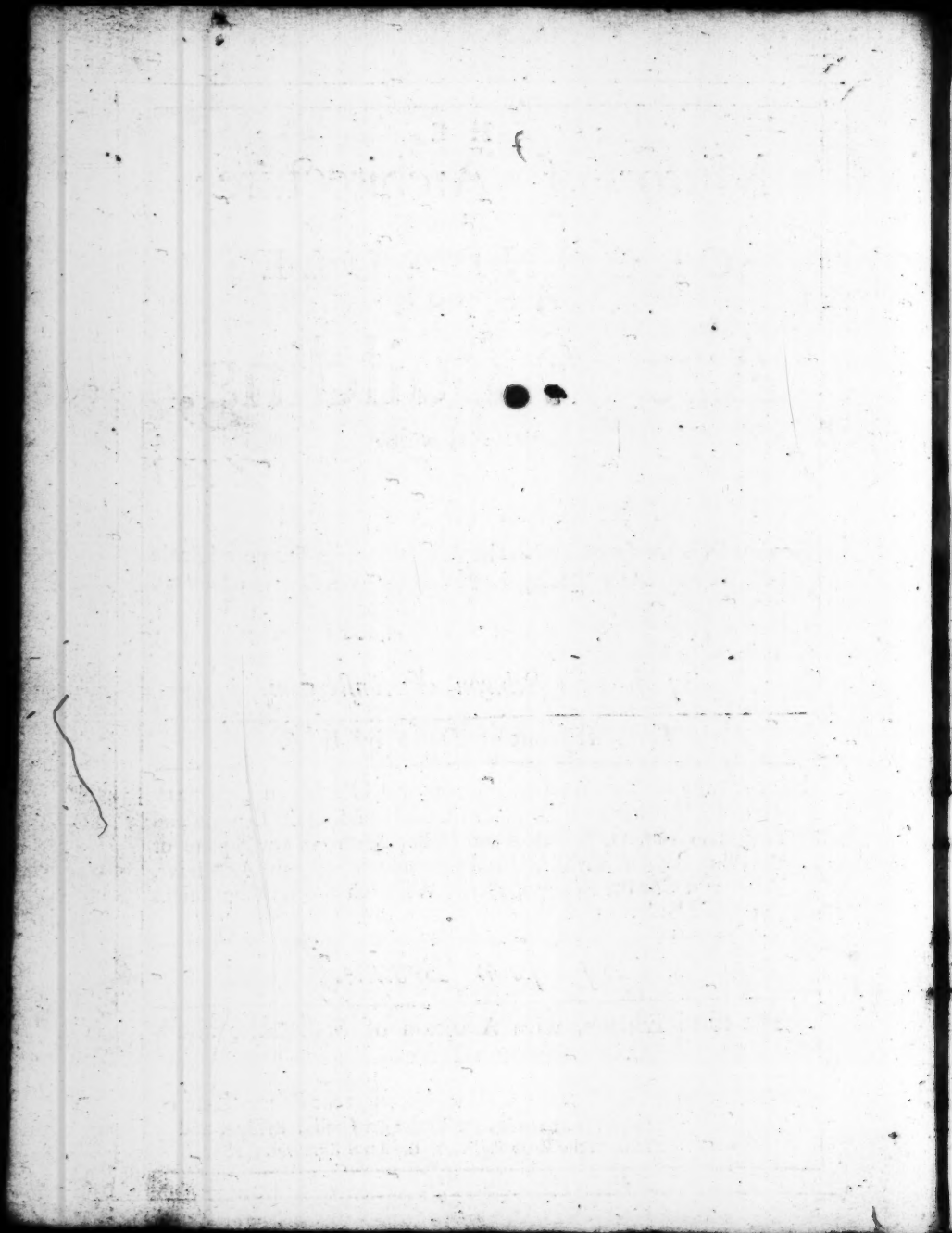
Translated out of *Dutch* by *W. F.*

Hereunto is added the Description and Use of an Ordinary
Joynt-Rule fitted with Lines for the ready finding the Lengths and
Angles of Rafter, and Hips and Collar-Beams in any Square or
Bevelling Roof at any Pitch, and the ready drawing the Architrave,
Frize, and Cornice in any Order. With other useful Conclusions
by the said Rule.

By *John Browne.* 10

The third Edition, with Addition of Stair-Cases and
Chimney-Pieces.

London: Printed for *W. Fisher*, and *R. Mount*, at the Postern-Gate on
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TO THE
LOVERS
OF
ARCHITECTURE.

Reader,



S in all things Order is to be observed that we may avoid Confusion, or else they will be a Chaos, as the Poets fancy; So especially in this excellent Art of Architecture it is requisite that every part and member have its right Order and due Proportion: And there having been many Masters who have with great Care and Industry brought this Art to a

To the Reader.

great Perfection, among whom this famous Master *Vincent Scamozzi*, Chief Builder of the Magnificent City of *Venice*, deserves to be placed in the first and chiefest rank by the consent of all Judicious Artists. Therefore for the benefit of our own Nation, and that it may be made most useful for all Artificers in Building, and Lovers and Practitioners in this most useful Art; who are or may be employed in Royal and Magnificent Structures. The larger Book is here reduced into a smaller Volume, and the Author his given Parts divided into Minutes; whereby the Principal Rules of Architecture are made plain to ordinary Capacities by *Foachym Schuym* an Ingenious Artist. And for your better understanding, take notice, that by Model is signified the Measure of the whole Diameter.

of

To the Reader.

of the Column: as for example: Let the Diameter be 18, 16, or 12 Inches, which shall be the Model divided into 60 Equal Parts or Minutes, (as you may see in the Diagonal Scale ensuing) by using which Measure all the Parts of the said Column shall be Proportionable: And this dividing of the Column into 60 Equal Parts or Minutes shall be used to all the Columns. Also here is added the Description and Use of an Ordinary Joynt-Rule fitted with Lines for the ready finding the Lengths and Angles of Rafters and Hips and Collar-Beams in any Square or Bevelling Roofs at any Pitch, and the ready drawing the Architrave, Frieze and Cornice in any Order, with other useful Conclusions by the said Rule.

In this Edition, that the Book may be the more compleat, you have a
Trea-

To the Reader.

Treatise containing the Ground-Rules of Architecture, being the Substance of what was writ of it by the Learned and Judicious Sir *Henry Wotton* in his Elements of Architecture, with the Figures of the Roman and *Corinthian* Stately Capitals, with Stair-Cases and Chimney-Pieces.

Accept favourably, and judge impartially.

Farewel.

The

The Description of the Scale, and its Use in dividing of the Parts in the Co- lumn easily found out, agreeing with the Measure of the Author.

No. I.

THE height of the uppermost Line AB is taken from the *Tuscan* Cornice (in the sixth Plate) and is divided into $4\frac{3}{8}$ parts: draw a Line straight up so long as you will, as CA, and divide into 5 equal parts, then divide the uppermost fifth part into 8 parts, and take 7 of them; and setting one foot of the Compasses in the Point C, and the other foot to the uppermost seventh part, draw an Arch of a Circle from that seventh part so far as the Line AB may be set on it from A to B, and draw a Line sloping from B to C, and draw every fifth part with the Compasses between the two Lines AC and BC; the undermost drawn Line GL is 1 part, HM 2 parts, IN 3 parts, KO 4 parts of the Line AB divided into $4\frac{3}{8}$ parts: then to divide the parts so, you must see what use you have thereof in your Cornice, and divide the Line AB into so many parts as there is occasion, as in 3 parts: so draw a Line $\frac{1}{3}$ from the point C, and into 4 parts, and draw a Line $\frac{1}{4}$ from the point C, and then into 5, and draw a Line $\frac{1}{5}$ from the point C. Then to strike out the small members of the Cornice, set the Compasses from H to the Line $\frac{1}{5}$, the which will give $\frac{3}{5}$ parts of the Line AB, then follows $\frac{1}{5}$: therefore set your Compasses on F and the Line $\frac{1}{5}$, then have you the $\frac{1}{5}$ part, next follows the part 1: therefore set your Compasses from G to L, the which is 1 part: then set the Compasses on G and the Line $\frac{1}{5}$, the which is then $\frac{1}{5}$ parts, then set your Compasses on F and $\frac{1}{4}$, and add that to GL, and it makes together $1\frac{1}{5}$ parts, then follow two parts $\frac{1}{5}$, then set the Compasses from I to the Line $\frac{1}{4}$, the which is $\frac{3}{4}$ parts, then on F and $\frac{1}{5}$, which is $\frac{1}{5}$ parts, then on H and $\frac{1}{5}$, which

is.

is $\frac{1}{3}$, and on G and the Line $\frac{1}{4}$, which is $\frac{1}{2}$, and do the like with every member of the Cornice and the Base, as you may see plainly in the sixth Figure.

No. II.

The Slope Line PQR is upon the Cornice of Composita, where is to be divided into 7 and $\frac{1}{2}$ parts, and one half twelfth part $7\frac{1}{2} : \frac{1}{2}$ and may be drawn after the same manner, as with the Dorick, Ionick and Corinthian, as you see plainly in the 24th Figure.

No. III.

The Author gives well the dividing the members in general of the Ornament, Inpost and Arch with the Base and Cimacia, but not so plain in particular how much every member must be. There have been several Lovers of the Art have endeavoured to find out the dividing of the minutes. So I thought necessary to put the minutes to it, and of the same to make a Scale. And for to make the Scale right, divide your Model into 6 parts on one side, and divide the other side into 10 parts, and so draw your Lines Diagonal ways, after the manner of the draught of the Diagonal Scale in the next leaf ensuing. So is your Scale made by which all the members are easily and rightly divided.

The

THE
GROUND-RULES
OF

Architecture,

Collected from the best Authors and Examples,

BY

That Learned and Ingenious Gentleman
Sir *HENRY WOTTON*,

IN HIS

Elements of ARCHITECTURE.
Now contracted for Publick Benefit.

L O N D O N:

Printed in the Year *MDCLXXXVI*.

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T H E
G R O U N D - R U L E S
O F
A R C H I T E C T U R E .

THere are several Rules or Precepts laid down by Architects concerning the Art of well Building, some respecting the situation or total posture of the Building ; as that it be in a good and healthy air, not subject to foggy noisomeness or mineral exhalations, or malign influence ; that it be not far from some navigable River or arm of the Sea ; that it have a pleasant prospect, and the first salutation of the Spring : But I pass over these, accounting them rather wishes than precepts.

Other Rules there are touching the placing of the several parts of the Building : As that all the principal Chambers of delight, all Studies and Libraries be towards the East, the morning being a friend to the Muses ; all Offices that require heat, as Kitchens, Stillatories, Stoves, Rooms for Baking, Brewing, Washing or the like, towards the South. All that need a cool and fresh temper, as Cellars, Pantries, Butteries, Granaries, to the North : As also Repositories for works of Rarities in Pictures, or other Arts that require a steady light. But in this, regard is to be had to the nature of the Region, every Nation being tyed above all Rules to a discretion of providing against their own inconveniences.

The Rules concerning the work it self, some respect the materials, and some the form ; as concerning the material part it will not disgrace an Architect, which doth so well become a

A

Philosopher,

Philosopher, to look into the properties of Stone and Wood, as that Firr-Trees, Cypress, Cedars, and such other aspiring Plants (which being naturally inflexible downwards) are fittest for Posts and Pillars, or such upright use; on the other side Oak and the like true hearty Timber being strong in all positions, may be better trusted in cros and traverse work for Sommers, or girding and binding beams, as they are termed And so likewise to observe of stone, that some are better within than other to bear weather; nay to descend lower, to examine Sand, Lime and Clay, of all which things *Vitruvius* and other new Writers have discoursed without any daintiness. And in this the *Italians* are very careful, burning their firmest Stone, and even fragments of Marble, where it is plenty, which in time become almost marble again, or at least of indissoluble durity, as appeareth in their standing Theatres: whereas to make Lime of any refuse stuf, as we too commonly do in *England*, is an error of no small moment in our Buildings. I shall close with this principal caution, That sufficient stuf and mony be ready before we begin to Build; for when we build now a piece and then another by fits, the work dries and sinks unequally, whereby the Walls grow full of chinks and crevices; this pawling humour is condemned by all Authors. In the form is to be considered the general figuration, and then the severall members. Figures are either simple or mixed, the simple figures are either Circular or Angular, and of Circular either complete or deficient as Oval: Now the exact Circle is in truth a very unprofitable Figure in private Buildings, being the most chargeable, and much room being lost in the bending of the Walls, besides an ill distribution of the light except from the Center of the Roof, so as it is not usual, save in some Temples and Amphitheatres; the Oval and other imperfect Circular Forms have the same exceptions and less benefit of capacity.

Touching the Angular it is a true observation, that this Art doth neither love many Angles nor few, for first the Triangle which hath of all others the fewest sides and corners, is of all other the most condemned, being indeed both incapable and infirm, and likewise more soluble into any other Form than it self in the inward Partitions: As for Figures of five, six, seven or more Angles, they are fitter for Military Architecture,

Architecture, where the Bulwarks may be laid out at the Corners, and the sides serve for the Curtains then for civil use, though there is a famous piece at *Caparola* belonging to the House of *Farnese*, cast by *Baraccio* into the form of a Pentagon with a Circle inscribed; where the Architect did ingeniously wrestle with divers inconveniences in disposing of the Lights and in saving the vacuities: but such designs as these do aim more at Rarity than Commodity, and are rather to be admired than commended. Therefore by the precepts and practice of the best Builders we resolve upon Rectangular squares, as a mean between too few and too many Angles, and are through the equal inclination of the sides (which make the right Angle) stronger than the Rhomb or any other irregular square; but whether the exact Quadrat or the long square be the better, is not well determined, though I prefer the latter, provided the length do not exceed the Latitude above one third part, which would much diminish the Aspect; as shall appear when I come to speak of Symmetry and Proportion of mixed Figures, partly Circular and partly Angular. There is a proper Objection, that they offend uniformity, yet these seeming opposites, Uniformity and Variety, may be reconciled; as we see in our Bodies, the great pattern of Nature, which are most uniform in the whole figuration, each side agreeing with the other in the number, the quality and measure of the parts, and yet some are round as the Arms, some flat as the Hands, some prominent, and some more retired, so the limbs of a noble Fabrique may be correspondent enough they be various, provided always we do not run into certain extravagant inventions, whereof I shall speak more largely when I come to the parting and casting of the whole work. We ought likewise to avoid enormous heights of six or seven stories, as well as irregular Forms, and the contrary fault of low distended Fronts is as unseemly, or again when the face of the Building is narrow and the flank deep. Thus much for the general Figuration or Aspect of the work.

Now concerning the parts in severall, all the parts of every Fabrick may be according to *Baptista Alberti* comprised under five Heads, and they be these.

The Foundation.

The Walls.

The Appertions or Overtures.

The Compartment.

And the Cover.

About all which I purpose to gather the principal Rules, and as I pass along touch the natural Reasons of Art.

First concerning the Foundation, which requireth the exactest care; for if that happen to dance, it will mar all the mirth in the House. Therefore that we may found our Habitation firmly, we must first examine the bed of Earth upon which we will build, and then the underfillings or substraction, as the Ancients did call it, advising us not to rest upon any appearing solidity, unless the whole mould through which we cut have likewise been solid. But how deep we should go in this search, is not certainly determined, depending more upon discretion than regularity, according to the weight of the work; yet *Andrea Palladio* alloweth a sixth part of the height of the whole Fabrick, unless the Cellars be under ground; in which case he would have us found somewhat lower.

Some *Italians* do prescribe, that when they have chosen the floor or plot, and laid out the limits of the work, we should first of all dig Wells and Cisterns and other under-conducts and conveyances for the suillage of the House, whence may arise a double benefit; for both the nature of the mould or soil would be safely searched, and moreover those open vents will serve to discharge such vapours as having otherways no issue might peradventure shake the building; This is enough for the natural grounding, which though it be not a part of the solid Fabrick, yet it is here fittest to be handled.

Now followeth the substraction or ground-work of the whole Edifice, which must sustain the Walls, about which are these Rules, first that the bottom be precisely level, where the *Italians* therefore commonly lay a platform of good board, then that the lowest ledg or row be merely of stone, and the broader

broader the better, closely laid without mortar, which is a general caution for all parts in building: that are contiguous to board or timber, because lime and wood are infociable, and if any where unfit confiners, than most especially in the Foundation; thirdly, that the breadth of the substruction be at least double to the insistent Wall, and more or less as the weight of the Fabrick shall require; for Discretion may be freer than Art.

Now the Foundation being searched; and the substruction laid, we must next speak of the Walls.

Walls are either entire and continual, or intermitted, and the intermissions be either Pillars or Pilasters; concerning the entire Walls there are these considerations. That the Walls be most exactly perpendicular to the ground-work; for the right Angle (thereon depending) is the true cause of stability both in artificial and natural positions, a man likewise standing firmest when he stands uprightest. That the massiest and heaviest materials be the lowest, as fitter to bear than to be born. That the work as it riseth, diminisheth in thickness proportionally for ease both of weight and expence. That certain ledges of more strength than the rest be interlayered like bones to sustain the Fabrick from total ruine, if the under parts should decay. Lastly, that the Angles be firmly bound, which are the Nerves of the whole Edifice, and therefore are commonly fortified by the *Italians* even in their brick buildings, on each side of the corners with well squared stone, yielding both strength and grace. And so much touching the entire or solid Wall.

The intermissions (as hath been said) are either Pillars or Pilasters.

Pillars, which are commonly called Columns, of them there are five Orders.

The Tuscan.

The Dorique.

The Ionique.

The Corinthian.

And

And the *Compound Order*, or as some call it, the *Roman*, others more generally the *Italian*.

In which five Orders I will first consider their Communities, and then their Proprieties.

Their Communities (as far as I observe) are principally three: First, they are all round; for though some conceive *Columna Atticurgae* mentioned by *Vitruvius* to have been a squared Pillar, yet we must pass it over as irregular, never received among these Orders, no more than certain other licentious inventions of wreathed and vined and Figured Columns.

Secondly, they are all diminished or contracted insensibly more or less, according to the proportion of their heights from one third part of their Shaft upwards, which *Philander* doth prescribe by his own precise measuring of the ancient remainders as the most graceful Diminution. And here I must blame a practice familiar in some places, of making Columns swell in the middle as if they were sick of some Tympany, unseemly to the very judgment of sight, and contrary to the Original and Natural Type in Trees, which at first was imitated in Pillars, as *Vitruvius* himself observeth.

Thirdly, they have all their Undersettings or Pedestals in height a third part of the whole Column comprehending the Base and Capital, and their upper Adjuncts, as Architrave, Frize, and Cornice, a fourth part of the said Pillar. Which rule of singular use and facility I find settled by *Jacobo Baraccio* a very good Author. These are their most considerable Communities and agreements.

Their Proprieties or Distinctions will best appear by some reasonable and plain description of them all with their Architraves, Frizes and Cornices.

First therefore the *Tuscan* is a plain massy rural Pillar, resembling some sturdy well-limbed Labourer homely clad, as *Vitruvius* makes the Comparison: The length thereof shall be six Diameters, or as *Scamozzi* makes it, six and a half of the grossest of the Pillar, being a very natural proportion. The distance or Intercolumniation may be near four of his own Diameters, because the materials commonly laid over this Pillar were rather of Wood than Stone,

stone, through the lightness whereof the Architrave could not suffer though thinly supported, nor the Column it self being so substantial. The Contraction aloft shall be (according to the most received practice) one fourth part of his thickness below. To conclude, the *Tuscan* is of all the rudest Pillar, and his principal Character simplicity.

The *Dorick Order* is the gravest that hath been received into civil use, preserving in comparison of those that follow a more Masculine Aspect, and little trimmer than the *Tuscan* that went before, save a sober garnishment now and then of Lions heads in the Cornice, and of Triglyphs and Metopes always in the Frize, sometimes likewise, but rarely, channeled, and a little slight sculpture about the Hypotrachelion or neck under the Capital: the length seven Diameters, and according to *Scamozzi* seven and a half, his rank or degree is the lowest by all congruity, as being more massie than the three, and so better able to support. The Intercolumniation thrice as much as his thickness below; the contraction aloft one fifth of the same measure, he is best known by his place when he is in Company, and by the peculiar Ornament of his Frize before mentioned when he is alone.

The *Ionick Order* doth represent a kind of Feminine slenderness, not like a light Housewife, but in a decent Matron-like dressing. The length eight Diameters in degree as in substantialness next above the *Dorick*, sustaining the third, and adorning the second story, the Intercolumniation two of his own Diameters, the contraction above one sixth part. And is best known by his trimmings, for the body of this Column is perpetually channeled like a thick plaited Gown; the Capital dressed on each side, not much unlike womens Wires in a spirial wreathing, which they call the *Ionian Voluta*; the Cornice indented; the Frize swelling like a Pillow, these are his best Characters.

The *Corinthian* is a Column lasciviously decked like a Cur-tizan, and therein participating (as all Inventions do) of the place where they were first born, *Corinth* having been without controversie one of the wantonest Towns in the World. This Order is of nine Diameters, his degree one stage above the *Ionick*, and always the highest of the simplest Orders.

The Intercolumniation two of his Diameters, and a fourth part more, which is of all other the comliest distance. The contraction one seventh part. In the Cornice both Dentils and Modiglions. The Frize adorned with all kinds of Figures and various Compartments. The Capital cut into one of the beautifullest leafs that Nature doth yield, which is the *Acanthas* or *Branca Urfina*, Bears Foot. In short, as Plaineſſe did characterize the *Tuſcan*, ſo muſt Delicacy and variety the *Corinthian* Pillar, beſides the height of his Rank.

The laſt is the Compounded or *Roman Order*, his name being a brief of his nature; for this Pillar is nothing in effect but a medly of all the precedent Ornaments, and though, the moſt richly trimmed, yet the pooreſt in this that he is a borrower of all his beauty. His length a mean between the *Ionick* and *Corinthian* according to *Scamozzi*: though ſome will have him the higheſt, as of ten Diameters, the contraction one eighth part leſs above than below, his degree ſhould be the higheſt, but few Palaces ancient or modern exceed the third of the Civil Orders; you may eaſily know him by the mixture of his Ornaments. And ſo much touching the five Orders of Columns, which I ſhall conclude with two or three not impertinent Cautions.

Fiſt, That where more of theſe Orders than one ſhall be ſet in ſeveral Stories or Contignations, there muſt be an exquisite care to place the Columns precisely one over another, that ſo the ſolid may answer to the ſolid, and the vacuities to the vacuities; as well for beauty as ſtrength of the Fabrick; and by this Caution the conſequence is plain, that when we ſpeak of the intercolumniation or diſtance which is due to each Order, we mean in a *Dorick*, *Ionical*, *Corinthian* Porch, or Cloiſter, or the like of one Contignation, and not in ſtoried buildings.

Secondly, Let the Columns above be a fourth part leſs than below, ſaith *Vitruius*; which doth appear a ſtrange Precept, and would ſeem reaſonable rather to make them a fourth part bigger, becauſe according to the Optick Rule that the higher they are the leſs the diminution aloft ſhould be, becauſe the Eye doth naturally contract all objects more or leſs according to their diſtance; but *Vitruius* acquits himſelf like

like a wise Mechanick, the Natural reason before the Mathematical.

That therefore they above should be a fourth part less, that those beneath may better sustain them.

A third Caution shall be, That all the projected or Jutting parts (as they are termed) be very moderate, especially the Cornices of the lower Orders ; for while some think to give them a beautiful and royal Aspect, by their largeness they sometimes hinder both the light within, and likewise detract much from the view of the Front without. I need say no more concerning Columns and their Adjuncts, only answer one familiar Objection: It will perchance be said, that this Doctrine touching the five Orders were fitter for the Quarries of *Asia* which yielded one hundred and twenty seven Columns of sixty foot high to the *Ephesian* Temple, or for *Numidia* where Marbles abound, then for the Spirits of *England*, who must be contented with more ignoble materials. To which I answer, that this need not discourage us. For I have often at *Venice* viewed with much pleasure an Antiporch after the *Greek* manner raised by *Andrea Palladio* upon eight Columns of the Compounded Order, the Basis of stone without Pedestals, the shafts or bodies of meer brick three foot and a half thick in the Diameter below, and consequently thirty five foot high, than which mine eye hath never yet beheld any Columns more stately of stone or marble; for the Bricks having been first formed in a Circular mould, and then cut before their burning into four quarters or more, the sides afterwards joyn so closely, and the points concentre so exactly, that the Pillars appear one entire piece; which short description I could not omit, that thereby may appear how in truth we want rather Art than Stuffs to satisfy our greatest fancies.

After Pillars the next in order are Pilasters, touching which I will briefly collect these Notes. Pilasters must not be too tall and slender, lest they resemble Pillars; nor too dwarfish and gross, lest they imitate the Piles or Peers of Bridges; smoothness doth not so naturally become them as a rustick superficies, for they aim more at State and Strength than Elegancy. In private Buildings they ought not to be narrower than one third, nor broader than two parts of the

whole vacuity between Pilaster and Pilaster; but to those that stand at the corners may be allowed a little more Latitude by discretion for strength of the Angles: In Theaters and Amphitheatres, and such weighty works, *Palladio* observeth them to have been as broad as the half, and now and then as the whole Vacuity; he noteth otherways, and others consent with him, that their true proportion should be an exact square; but for lessening expence and enlarging of room, they are commonly narrower in flank than in front. Their principal grace doth consist in half or whole Pillars applyed unto them; in which case it is well noted by Authors, that the Columns may be allowed somewhat more than their ordinary length, because they lean unto so good supporters. And thus much shall suffice touching Pilasters, which is a Cheap, and a Strong, and a Noble kind of Structure.

Now because they are oftner both for Beauty and Majesty found Arched than otherwise: I am here orderly led to speak of Arches, and under the same head of Vaults, for an Arch is nothing indeed but a contracted Vault, and a Vault is but a dilated Arch.

Therefore to handle this business both compendiously and fundamentally, I will resolve the whole business into a few Theorems.

Theorem 1.

All solid Materials free from impediment do descend perpendicularly downwards, because ponderosity is a natural inclination to the Center of the world, and Nature performeth her motions by the shortest lines.

Theorem 2.

Bricks moulded in their ordinary Rectangular form, if they shall be laid one by another in a level row between any supporters, sustaining the two ends, then all the pieces between will necessarily sink even by their own natural gravity,

vity, and much more if they suffer any depression by other weight above them, because their sides being parallel they have room to descend perpendicularly without impeachment, according to the former Theorem: Therefore to make them stand, we must either change their posture, or their figure, or both.

Theorem 3.

If Bricks moulded or Stones squared *cuneatim* (that is wedg-wise broader above than below) shall be laid in a row level with their ends supported as in the precedent Theorem, pointing all to one Center, then none of the pieces between can sink till the Supporters give way: because they want room in that figuration to descend perpendicularly: But this is yet a weak piece of structure, because the supporters are subject to much impulsion, especially if the line be long; for which reason this Form is seldom used but over Windows or narrow Doors; therefore to fortifie the work, as in this third Theorem we have supposed the Figure of all the Materials different from those in the second, so likewise we must now change the posture, as will appear in the Theorem following.

Theorem 4.

If the materials figured as before wedg-wise shall not be disposed levelly but in form of some Arch or proportion of a Circle pointing all to the same Center: In this case neither the pieces of the said Arch can sink downwards through want of room to descend perpendicularly, nor the supporters or buttments (as they are termed) of the said Arch can suffer so much violence as in the precedent flat posture, for the roundness will always make the incumbent weight rather to rest upon the supporters than to shove them; whence may be drawn an evident Corollary, that the safest of all Arches is the Semicircular, and of all Vaults the Hemisphere, though not absolutely exempted from some natural weakness, as *Barn.*

Baldi

Baldi Abbot of *Gnaftalla* in his Comment upon *Aristotles* Mechanicks doth very well prove; whence I note, That when any thing is Mathematically demonstrated weak, it is much more Mechanically weak; errors ever more occurring more easily in the management of gross materials than lineal designs.

Theorem 5.

As Semicircular Arches or Hemispherical Vaults being raised upon the Total Diameter be of all other the roundest, and consequently the surest by the precedent Theorem; so those are the gracefullest, which keeping precisely the same height shall yet be distended one fourteenth part longer than the said entire Diameter, which addition of distent will confer much to their Beauty, and detract but little from their strength. This observation I find in *Leon. Baptista Alberti*; but the practice how to preserve the same height, and yet distend the ends of the Arch, is in *Albert Durers* Geometry, who taught the *Italians* many an excellent Line of great use in this Art.

Upon these five Theorems all the skill of Arching and Vaulting is grounded: As for those Arches which our Artizans call of the third and fourth point, and the Tuscan Writers *di terzo*, and *di quarto acuto*, because they always concur in an acute Angle, and do spring from the division of the Diameter into three, four or more parts at pleasure; I say, these both for the natural imbecillity of the sharp Angle it self, and likewise for their very uncomeliness ought to be exiled from judicious eyes, and left to their first Inventers the *Goths* or *Lombards*, amongst other Relicks of that barbarous Age.

Thus of my first Partition of the parts of every Fabrick into five heads; having gone through the two former and been incidently carried into this last Doctrine touching Arches and Vaults, the next now in order are the Apertions, under which term I do comprehend doors, windows, stair-cases, chimnies, or other conducts; in short, all Inlets or Outlets, to which belong two general cautions.

First,

First, That they be as few in number and as moderate in dimension as possibly may consist with other due respects; for in a word, all openings are weaknings.

Secondly, That they do not approach too near the Angles of the Walls, for it were indeed a most essential Solecism to weaken that part which must strengthen all the rest: A precept well recorded but ill practised by the *Italians* themselves, particularly at *Venice*, where I have observed divers *Pergoli* or *Meniana* (as *Vitruvius* seemeth to call them) which are certain ballisted outstandings to satisfie curiosity of sight) very dangerously set forth upon the very point it self of the *Mural* Angle.

Before I come to the casting and comparting of the whole work (being indeed the very definitive sum of this Art, to distribute usefully and gracefully a well chosen plot) I shall collect some Notes belonging to these particular Overtures.

Of Doors and Windows.

These Inlets of men and light I couple together, because I find their due dimensions brought under one Rule, by *Leon. Alberti* (a learned searcher) who from the School of *Pythagoras* (where it was a fundamental Maxim, that the Images of all things are latent in numbers) doth determine the comliest proportions between breadths and heights, namely the Symmetry of two to three in their breadth and length, in others the double, as two to four, there will indubitably result from either a graceful and harmonious contentment to the Eye. Our Master *Vitruvius* seems to have been an extream lover of luminous Rooms, and indeed I confess that a frank light can misbecome no Edifice, yet on the other side we must take heed to make a House all Eyes like *Argus*, which in Northern Climates would be too cold, in Southern too hot. Besides there is no part of Building more expenceful than Windows, or more ruinous, not only for that vulgar reason as being exposed to all wind and weather, but because consisting of so different and unfociable pieces, as Wood, Iron, Lead and Glass, and those small and weak, and easily shaken.

Of Doors there is this distinction; some were called *Fores*, some *Valve*; Those, as the word may seem to import, did open outwards, these inwards, and were commonly of two leaves or panes (as we call them) thereby requiring indeed a lesser Circle in their unfolding, and therefore much in use among the *Italians* at this day. But I charge them with an Imperfection, for though they let in as well, yet they keep out worse.

Of Stair-Cases.

To make a compleat stair-case is a curious piece of Architecture; the vulgar cautions are these.

That it have a liberal light against all Casualties of slips and falls.

That the space above the head be large and airy, because a man doth spend much breadth in breathing.

That the half paces be well distributed at competent distances for reposing on the way.

That to avoid Encounters, and besides to gratifie the beholder, the whole stair-case have no niggard Latitude, that is, for the principal Ascent in Royal Buildings at the least ten foot.

That the breadth of every single step or stair be never less than one foot, nor more than eighteen inches.

That they exceed by no means half a foot in their height or thickness, for our legs do labour more in elevation than in distention.

That the steps be laid where they join somewhat sloping, that the foot may in a sort ascend and descend together; which though observed by few, is a secret and delicate deception of the pains in mounting.

Lastly, to reduce this doctrine to some Natural or at least Mathematical ground, *Viruvius* borroweth these proportions that make the sides of a Rectangular Triangle; that is, three for the Perpendicular from the stair-head to the ground, four for the ground-line it self or recession from the Wall, and five for the whole Inclination or slopeness in the Ascent. There are likewise Spiral or Cocklestairs, and sometimes running about a Pillar, sometimes vacant, wherein *Palladio* (a man very expert
in

in this point) was wont to divide the Diameter of the first fort into three parts, yielding one to the Pillar and two to the Steps of the second, into four whereof he gave two to the Stairs, and two to the Vacuity, which had all their light from above, and this in exact Oval is as a Master-piece. You have here inserted the Types of several Stair-Cases with their Ichnography; one whereof is a piece of Rarity, being a pair of double Stairs, whereon two persons, the one ascending, the other descending, shall not come at one another, made by *Peidro del Bergo* and *Jehan Cofin* at *Sciamburg* in *France* in the Kings Palace.

Describe a Semicircle for the Ichnography, which divide in 12 equal parts, and in it describe a smaller Circle as at C. For the bigness of the Newel draw lines from those Divisions in the great Semicircle into the Semicircle made for the bigness of the Newel, so will that Semicircle also be divided into 12 equal parts; then on every of the points in the great Semicircle erect Perpendiculars, and those Perpendiculars shall shew the ends of each respective step; as the Perpendicular at 11 bounds the outward end of the first step, the Perpendicular at 22 bounds the second step, &c. to 24, which makes good a whole Circle in the Ichnography, and Perpendiculars erected from the inner Semicircle mark on the Newels the ends of the same steps: work the same way with the steps on your right hand. The Newel is pierced through in divers places to let in light.

Of Chimnies.

The *Italians*, who make frugal fires, are not in this case the best Counsellors, therefore from them we may better learn how to raise fair Mantles within, and how to disguise gracefully the shafts of Chimnies abroad; therefore shall lay down the Observations of *Phil. de l'Orme*, a man diligent in this part of work.

First he observeth, that who in the disposition of the Building will consider the Region and the Winds that ordinarily blow from this or that Quarter, might so cast the Rooms, which need most fire, that he should little fear the incommmodity of Smoke. But if the Error lies in the Structure it self, then he makes a Logical Enquiry, That either the Wind is too much let in above at the mouth of the Shaft, or the Smoke stifled below. If none of these, then there is a repulsion of the Fume by some higher Hill

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or

or Fabrick that overtops the Chimny; if likewise not this, then he concludes that the Room is little and close, so as the Smoke cannot issue wanting a supply of Air; and so having a Natural Reason of the Cause, we apply suitable Remedies.

Touching Conducts for the Suillage and other Necessities of the House, (which how base soever in use, yet for the Health of the Inhabitants are as considerable as the rest) I find in Authors this Counsel, that Art should imitate Nature in those ignoble Conveyances, and separate them from sight (where there wants a running Water) into the most remote, and lowest, and thickest part of the Foundation, with secret vents posting up through the Walls, like a Tunnel to the wild Air aloft.

Thus, having considered the *Apertions* and *Overtures* according to their particular Requisites, I come to the Contexture of the whole work under the term of *Compartition*, into which (being the mainest piece) I cannot enter without a few general Precautions.

First, Let no man that intendeth to build, settle his fancy upon a Draught of the Work in Paper, how exactly soever measured or neatly set off in perspective, without a Model or Type of the whole Structure, and of every parcel or partition in Board or Wood.

Next, That the said Model be as plain as may be without Colours or other beautifying, lest the Pleasure of the Eye preoccupate the Judgment.

Lastly, The bigger this Type is, the better; not that I would persuade a man to such an Enormity, as that Model made by *Ant. Labaco* of *St. Peters Church in Rome*, containing 22 foot in length, 16 in breadth, and 13 in height, and costing 4184 Crowns, the price of a reasonable Chappel. Yet in a Fabrick of 30 or 40 Thousand pounds, 30 pounds may be expended in an exact Model; for a little Penury in the Premises may easily breed some Absurdity of a far greater Charge in the Conclusion.

Now after these Premonishments, I come to the *Compartition* it self, by which is understood a graceful and useful Distribution of the whole Ground-plot, both for Rooms of Office and of Reception or Entertainment, as far as the Capacity thereof and the nature of the Country will comport.

The Gracefulness will consist in a double Analogy or Correspondency, First, between the Parts and the Whole, whereby a great Fabrick should have great Partitions, great Lights, great Entrances, great Pillars or Pilasters; in sum, all the Parts great.

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The next between the Parts themselves, not only considering the breadth and length, as before when we spake of Doors and Windows, but likewise their height, a point hardly reducible to any general Precept.

True it is, the Ancients did determine the Longitude of all Rooms which were longer than broad, by the double of their Latitude; and the Height half as much more as the Latitude, which Dimensions modern Architects vary upon discretion: sometimes squaring the Latitude, and then making the Diagonal or overthwart Line from Angle to Angle of the said square; the measure of the Height sometimes more, but seldom lower, than the breadth it self.

The usefulness consists in a sufficient Number of Rooms of all sorts, and their apt Coherence without Distraction, without Confusion, that it may be well united, and may appear airy and spiritous, fit for the welcome of chearful Guests; about which the greatest difficulty will be in contriving the Lights and Stair-cases; in which respect the ancient Architects were at much ease; for both the *Greeks* and *Romans* (of whose private Dwellings *Vitruvius* hath left some Description) had commonly two Cloistered open Courts, one serving for the Womens side, and the other for the Men, who now adays would perchance take so much separation unkindly. Howsoever by this means the reception of Light into the body of the Building was very prompt both from without and from within, which we must now supply by some open form of the Fabrick, or among graceful refuges by Tarrasing any story which is in danger of Darknes, or lastly, by perpendicular Lights from the Roof, of all others the most natural: For the second difficulty, which is casting the Stair-Case, which is no hard point of it self, but as they are incumbrances of room for other use, I have marked a willingness in the *Italian* Artizans to distribute the Kitchen, Pantry, Bake-house, washing Rooms, and even the Buttry likewise under ground next above the Foundation, and sometimes level with the Floor of the Cellar, raising the first Ascent into the House fifteen foot or more for that end, which besides removing Annoys out of sight and gaining much room above, doth also by the Elevation of the Front add Majesty to the whole Aspect; and with such a disposition of the principal Stair-Case which commonly doth deliver us into the plain of the second Story, there may be wonders done with a little room.

But though petty Offices may be well enough so remote, yet by the natural Hospitality of *England* the Buttry must be more visible, and we need perchance for our Raunges a more spacious and luminous Kitchin than the aforesaid Compartition will bear, with a more competent nearness to the Dining Room. It is likewise necessary to contrive a Room for a Conservatory of the Meat that is taken from the Table till the Waiters eat, which with us by an old fashion is more unseemly set by in the mean time.

Now touching the distribution of Lodging Chambers, I must here reprove a Fashion, which hath prevailed through *Italy*, without antient Examples: Namely, that they so cast their Partitions, as when all Doors are open, a man may see through the whole House; which doth necessarily put an intolerable servitude upon all the Chambers, save the inmost, whence none can arrive but through the rest, or else the Walls must be extreme thick for secret Passages. And yet this will not serve the turn, without at least three Doors to every Room, a thing most insufferable in cold and windy Regions, and every where no small weakning to the whole Work; being only grounded upon the fond Ambition of displaying to a Stranger all our Furniture at one sight: there being another defect, which necessarily follows such a servile disposing of inward Chambers, that they must be forced to make as many common great Rooms, as there shall be several Stories; which (besides that they are usually dark, a point hardly to be avoided, running as they do through the middle of the whole House) do likewise devour so much Place, that thereby they want other Galleries and Rooms of Retreat. Thus having given you general Lights and Directions, and discovered some Faults, the rest must be committed to the Sagacity of the Architect, who will be often put to divers ingenious shifts, when he is to wrestle with Scarcity of Ground: as sometimes to damme one Room (though of good use) for the benefit and beauty of all the rest; another while to make those fairest which are most in sight, and to leave the other (like a cunning Painter) in shadow. I will close this Part, touching *Compartition*, as cheartfully as I can, with a short Description of a feasting or entertaining Room after the *Egyptian* manner, who seem (at least till the time of *Vitruvius*) from the antient *Hebrews* and *Phanicians* (whence all Knowledge did flow) to have retained with other Sciences in a high degree, also the Principles and Practice of this magnificent Art;

Art; there being no Form for such a Royal use comparable imagined like that of the aforesaid Nation.

Let us conceive a Floor or Area of goodly length (for example at least of 120 Foot) with the breadth somewhat more than half of the longitude: About the two longest sides and head of the said Room shall run an Order of Pillars, which *Palladio* doth suppose *Corinthian*, supplying that point out of *Greece*, because we know no Order proper to *Ægypt*; the fourth side I will leave free for Entrance: On the foresaid Pillars was laid an Architrave, which *Vitruvius* mentioneth alone, *Palladio* adds thereunto (and with reason) both Frize and Cornice, over which went up a continued Wall, and therein half or three-quarter Pillars, answering directly to the Order below, but a fourth part less; and between these half Columns above, the whole Room was windowed round about.

Now from the lowest Pillars there was laid over a Contignation or Floor born upon the outward Wall and the head of the Columns with Tarrace and Pavement *sub dio*, saith our Master, and so indeed he might safely determine the matter in *Ægypt*, where they fear no Clouds; therefore *Palladio* (who leaveth this Tarrace uncovered in the middle and ballised about) did perchance construe him rightly, though therein discording from others. Always we must understand a sufficient breadth of Pavement left between the open Part and the Windows, for some delight of Spectators that might look down into the Room. The Latitude I have supposed contrary to some former Positions a little more than half the Length; because the Pillars standing at a competent distance from the outmost Wall, will by interception of the sight, somewhat in appearance diminish the breadth: In which cases (as I have said before) Discretion may be more licentious than Art. This is the Description of an *Ægyptian* Room for Feasts and other Jollities; about the Walls whereof we must imagine intire Statues placed below, and illuminated by the descending Light from the Tarrace, as likewise from the Windows between the half Pillars above. So as this Room had abundant and advantageous Light; and besides other garnishing must needs receive much State by the Height of the Roof, that lay over two Orders of Columns.

And so having run through the four Parts of my first general Division, namely, *Foundation, Walls, Apertions, and Compartment*:

The

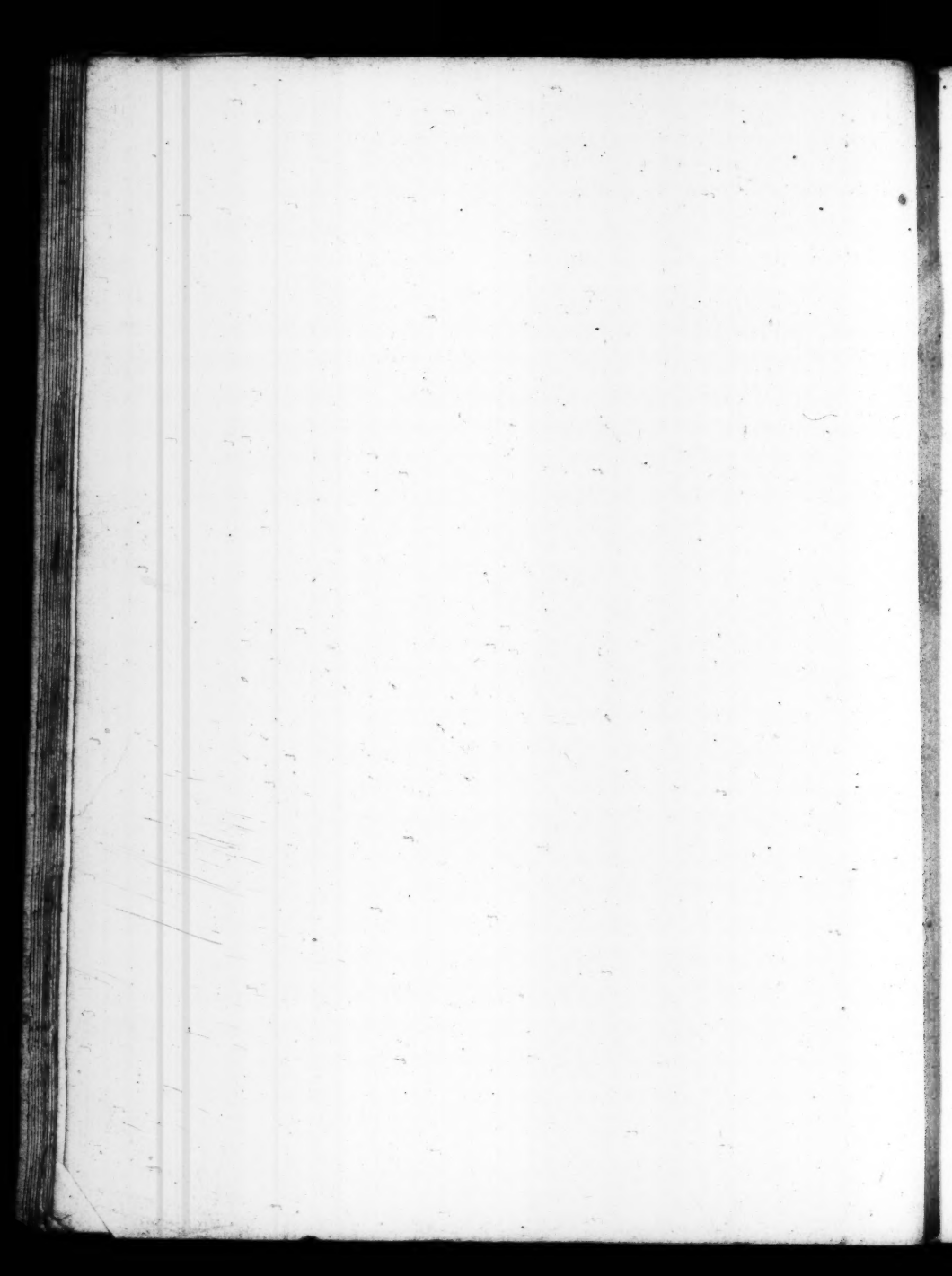
The House may now have leave to put on his Hat, having hitherto been uncovered it self, and consequently unfit to cover others; which point, though it be the last of this Art in Execution, yet it is always in Intention the first; for who would build but for shelter? I shall now only deliver a few of the properest, and (as I may say) naturallest Considerations that belong to this remaining Piece.

There are two Extremities to be avoided in the Cover or Roof, that it be not too heavy nor too light, the first will suffer a vulgar Objection of pressing too much the Under-work. The other containeth a more secret Inconvenience, for the Cover is not only a bare Defence, but likewise a kind of Band or Ligature to the whole Fabrick, and therefore would require some reasonable Weight; but of the two a House top-heavy is the worst, next, there must be a care of Equality, that the Edifice be not pressed on the one side more than on the other. And here *Palladio* doth wisely advise that the inward Walls might bear some good share in the Burthen, and the outward be the less charged. Thirdly, the *Italians* are very careful in giving the Cover a graceful Pendence or Slopeneſs, dividing the whole breadth into nine parts, whereof two shall serve for the Elevation of the highest Top or Ridg from the lowest. But in this point, the quality of the Region is considerable; for as our *Vitruvius* insinuateth, those Climes that fear the falling and lying of much Snow, ought to provide more inclining Pent-houses, and Comelineſs must yield to Necessity.

Thus have you briefly laid down, from the best Authors, the Ground-Rules of the Art of Building; which being well considered, may be of great use to the ingenious Architect in the managing of any Royal or Noble Design.

F I N I S.





I

THE
DESCRIPTION
Of the five Orders of
Architecture,

And first
Of the TUSCAN Order.

Note, that the Number in the several Divisions with the following Explanations, refer to the Figures in the Book as they are marked from 1 to 40.

I.

IN the first Figure here is shown the several Orders of Columns how they differ from each other, and how high every one must be.

The Tuscan must be $11 \frac{1}{4}$ Models high; whereof the Pedestal must be $1 \frac{1}{8}$ Model, or 1 Model $52 \frac{1}{2}$ minutes; the Column must be $7 \frac{1}{2}$ Models, the Ornament must be $1 \frac{1}{2}$ Model, and so the Ornament is one fourth of the height of the Column, and the Pedestal also is one fourth of the height of the Column.

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The *Doric* must be 12 Models $53\frac{1}{2}$ minutes high; whereof the Pedestal must have 2 Models and 16 minutes; the Column must be $8\frac{1}{2}$ Models; the Ornament must be $2\frac{1}{2}$ Models: so the Ornament is one fourth of the height of the Column, and the Pedestal is $3\frac{1}{2}$ of the height of the Column.

The *Ionick* must be 13 Models high; whereof the Pedestal must have $2\frac{1}{2}$ Models; the Column must have eight Models and three fourths; the Ornament must have $1\frac{1}{2}$ Model: and so the Ornament comes to be one fifth part of the height of the Column, and the Pedestal $3\frac{1}{2}$ of the height of the Column.

The *Roman* or the *Composita* must be $14\frac{2}{3}$ Models high, or 14 Models 42 minutes; whereof the Pedestal must be 3 Models; the Column $9\frac{1}{2}$ Models; and the Ornament must have $1\frac{1}{2}$ Model, or 1 Model and 57 minutes: so the Ornament comes to be one fifth part of the height of the Column, and the Pedestal $3\frac{1}{4}$ of the height of the Column.

The *Corinthian* must be $15\frac{1}{3}$ Models high; whereof the Pedestal must be $3\frac{1}{3}$ Models, the Column must be 10 Models; the Ornament must have 2 Models: and so the Ornament comes to be one fifth part of the height of the Column, and the Pedestal one third of the height of the Column.

II.

If you would make Galleries without the Pedestal, you must take the height of $9\frac{2}{3}$ Models to make the work the more stately; so you may make one gross Base under of $\frac{1}{2}$ Model: the breadth must be $11\frac{1}{3}$ Models; the middle inter-Column must be 3 Models; the inter-Column of either side must be $2\frac{1}{3}$ Models. But if you will make them of six Columns, they must be $18\frac{1}{3}$ Models, and of eight Columns, they must be 25 Models: the height for the lights of the Gate must be $\frac{2}{3}$ of the height of the Column, with his Architrave and Frieze, and comes to 4 Models and 59 minutes; and the breadth is $\frac{2}{3}$, the height is 2 models and $29\frac{1}{2}$ minutes: The Ornament must be one fourth of the height of the lights, the door is $1\frac{1}{4}$ Model.

III.

The *Tuscan* Arch must be 3 Models and 52 minutes wide; the Pilasters under to the foot of the Column must be 34 minutes; the height to the top of the Impost is 5 models and 16 minutes; the Impost is 27 minutes high, divided into $8\frac{1}{2}$; the small Arch or Bow is 26 minutes divided into 8 parts: the Arch must make an half Circle, and somewhat more than $\frac{1}{4}$ of the Model; and for the projecture of the Impost to diminish the light. Upon the right and left side you must make Windows; of the middle Gate the Key-piece is 40 minutes high.

IV.

If you will make the *Tuscan* Gallery with the Pedestal, the whole height must be $11\frac{1}{4}$ Models, and the breadth $13\frac{1}{2}$ models of both the outermost Columns distance, whereof the middle inter-Column must be 3 models 40 minutes; the inter-Columns on the right and the left side must be 3 models: But if you make the Gallery of 6 Columns, they must be $21\frac{2}{3}$ models; and if they be of eight Columns, they must be $29\frac{2}{3}$ models: The height for the lights of the Gate must be $\frac{2}{3}$ parts of the under-edge of the Pedestal, to the upper edge of the Frieze, and 6 models and $3\frac{2}{3}$ minutes; and the breadth is $\frac{2}{3}$ parts, and is 3 Models and $1\frac{1}{2}$ minute: the Ornament must be one fourth of the height of the lights of the Door, and is 1 model and 31 minutes, whereof the Architrave must be $30\frac{1}{3}$ minutes; the Frieze $24\frac{1}{4}$ minutes; the Cornice $36\frac{1}{2}$ minutes.

V.

The *Tuscan* Arch is in distance from one Pedestal to the other 4 models 20 minutes; the Pilaster on the foot of the Column is 40 minutes; the height from under the Pedestal, to the upper edge of the Impost, is 6 models, $12\frac{1}{2}$ minutes; the height of the Impost is $41\frac{1}{2}$ minutes; the Arch or Bow is 20 minutes; the Key-piece in the Arch is 50 minutes high; the Arch is higher $\frac{1}{2}$ a Circle and 10 minutes for the projecture of the Impost: there the Arch beings, divided into 5 parts, 4 of the same are for the lights of the Door of the principal Gate, and is 5 models and 5 minutes; the breadth of the lights is 2 models $32\frac{1}{2}$ minutes; the Ornament is 1 model $16\frac{1}{2}$ minutes high, whereof the Architrave muh have $25\frac{1}{2}$ minutes; the Frieze 20 $1\frac{1}{2}$ minutes; the Cornice $30\frac{1}{2}$ minutes: or divide the Ornament 1 model 16 minutes in fifteen parts, and give five to the Architrave, four the Frieze, fix the Cornice.

VI.

The sixth shews the particular members of the *Tuscan* Column: On the right side have we the Pedestal and the Base: the Pedestal is $\frac{1}{4}$ of the height of the Column, and comes to $1\frac{1}{8}$ model, which must be divided into 5 parts; whereof give the under-Cimacium and the Plinth $1\frac{1}{2}$ of the Troco, make $2\frac{2}{3}$ the upper Cimacium 1 part, the upper Cimacium is $22\frac{1}{2}$ minutes: divided into $5\frac{1}{2}$ parts, the Base is $\frac{1}{2}$ a model, and is to be divided into 5 parts. Under the body of the Column is one small list of $\frac{1}{2}$ part, making 3 minutes: of the left side is the Ornament and the Capital; the Capital is $\frac{1}{2}$ model high, and is to be divided in 10 parts; the like part hath also the Astragal; the Ornament is $\frac{1}{4}$ off; the Column high take $1\frac{7}{8}$ model: this divided in $17\frac{1}{2}$ parts, whereof give the Architrave 5 prrts, the Frieze $6\frac{1}{3}$ parts; the Cornish 6 parts; the Architrave 5 parts, is $32\frac{1}{2}$ minutes, divided in $8\frac{7}{8}$ parts; the Frieze is 41 minutes, with his uppermost list, which is placed right over the middle of the Column, so high as the Frieze is, and the breadth 30 minutes: after this breadth the Frieze jets out $7\frac{1}{2}$ minutes. Here is also after the Frieze the List of $2\frac{1}{2}$ minutes; the Ornament

ment is 39 minutes high, divided in $4 \frac{1}{2}$ parts, so you may this Column, and all its members, with the Impost; and also all the other four Columns must be divided after the same manner with minutes; whereof the Column must be divided into sixty minutes, and made after this manner: The Scale is made in the first Figure, and the Rule wherewith you divide your parts shall be set P, and for minutes an M. it may be easily understood.

VII.

Here followeth the great and small Impost with his Arch and Ornament of the Principal Gates; upon the right side is the Impost and Arch; the Impost and Arch of the small Arch stands beneath, marked with the Letter K; the Impost is 27 minutes high, divided in $8 \frac{1}{4}$ parts; the like part hath Astragal of the Impost: the small Arch or Bow is 26 minutes, divided in $8 \frac{3}{4}$ parts; the height of the great Impost is $41 \frac{1}{2}$ minutes divided in 6 parts; the great Arch or Bow is 29 minutes high, divided in $8 \frac{3}{4}$ parts. Of the left side is the Ornament of the principal Gate, and is 1 model $16 \frac{1}{2}$ minutes high, whereof cometh $25 \frac{1}{2}$ minutes: the Architrave divided into $8 \frac{1}{3}$ parts; the Frieze is $20 \frac{1}{2}$ minutes high; the Cornish is $30 \frac{1}{2}$ minutes high, divided in $4 \frac{1}{3}$ parts.

VIII.

Of the DORICK Order.

IF you will make the DORICK Gallery without the Pedestal, then must you divide the whole height into 10 models $37 \frac{1}{2}$ minutes; and to make the Work appear the statelier, you may make one gross Base under of half a model high, and of 4 Columns breadth must be 9 models 45 minutes; whereof the middle inter-Column must be $2 \frac{3}{4}$ models; the inter-Columns of either side must be $1 \frac{1}{2}$ model; of 4 Columns breadth in the Frieze must be 8 Triglyphs, and 7 Metops: but you will make them of 6 Columns, you must divide the breadth into $14 \frac{3}{4}$ models; and there must be in the

the Frieſe of the 6 Columns 12 Triglyphs and 11 Metops: Alſo if you will make the Gallery of eight Columns; then muſt the breadth be $19 \frac{1}{4}$ models; the height of the lights of the door is $\frac{2}{3}$ of the height of the column with his Architrave and Frieſe, and comes to $5 \frac{1}{3}$ models and the breadth of the light of the door muſt be 2 models 40 minutes: the Ornament muſt be $\frac{1}{4}$ of the height of the lights of the door; and is 1 model 20 minutes divided in 15 parts; give 5 to the Architrave, 4 the Frieſe, 6 the corniſh; and ſo the Architrave is $26 \frac{2}{3}$ minutes, the Frieſe $21 \frac{1}{3}$ minutes, the Corniſh 32 minutes.

IX.

The *Dorick* Arch muſt be 6 models 15 minutes wide from the middle of one Column, to the middle of the other; and muſt ſtand a little more than half out of the Pilafter: the Pilafter is 32 minutes broad under on the Foot of the Column; the Impoſt is $27 \frac{1}{2}$ minutes high, divided in $8 \frac{1}{2}$ parts: the like part alſo hath the Aſtragal: underneath the height of the Arch or Bow is $27 \frac{1}{4}$ minutes divided into $6 \frac{1}{4}$ parts; the Key-piece in the Arch is high 40 minutes; the Arch is higher than half a Circle 10 minutes for the Projecture of the Impoſt; the height to the top of the Impoſt from the Baſe is 6 models $4 \frac{1}{2}$ minutes.

X.

The *Dorick* Gallery with the Peđaſtal; the whole height of the Column muſt be 12 models and $53 \frac{1}{2}$ minutes; and four Columns muſt be $13 \frac{1}{2}$ models broad, whereof the middle inter-Column muſt be 4 models; the inter-Column of the ſide $2 \frac{3}{4}$ models: Upon the four Columns muſt be 11 Triglyphs and 10 Metops; but 6 Columns muſt be 21 models broad, and 17 Triglyphs, and 16 Metops; but 8 Columns muſt be the breadth of $28 \frac{1}{2}$ models, 23 Triglyphs and 22 Metops: the light of the door is $\frac{2}{3}$ of the under edge of the peđaſtal, to the uppermoſt edge of the Frieſe, and is 6 models $57 \frac{1}{4}$ minutes; the breadth is 3 models $24 \frac{1}{2}$ minutes; the Ornament is high one fourth of the height of
the

the lights, and $\frac{1}{4}$ which is 1 model $38\frac{1}{2}$ minutes, whereof the Architrave must have $32\frac{1}{2}$ minutes, the Frieſe $26\frac{1}{2}$ minutes, the Corniſh $39\frac{1}{4}$ minutes.

XI.

If you would make the *Dorick* Gallery with the *Pedaſtal*, then muſt the diſtance from one *Pilaſter* to the other be $5\frac{1}{4}$ models; the height from the under-edge of the *Pedaſtal* to the upper-edge of the *Impoſt*, is 7 models 6 minutes; the *Impoſt* is 50 minutes high; the Arch or Bow 34 minutes; the Corner-piece is 50 minutes; the Arch is higher than a half-Circle $12\frac{1}{2}$ minutes for the projeſture of the *Impoſt*; the height of the lights for the Doors is 5 models and 52 minutes: the breadth of the Lights is two models and 52 minutes: the Ornament is 1 model $23\frac{1}{2}$ minutes high, of which the Architrave hath $27\frac{1}{2}$ minutes; the Frieſe is $22\frac{1}{4}$ minutes; the Corniſh is $33\frac{1}{2}$ minutes: or divide the Ornament in 15 parts, 5 the Architrave, 4 the Frieſe, 6 the Liſt.

XII.

Here is ſhown the particular members of the *Dorick* Column: On the right ſide we have the *Pedaſtal* and the *Base*; the *Pedaſtal* is $3\frac{1}{4}$ of the height of the Column, and comes to 2 models and 16 minutes, divided into 6 parts; whereof give the under-*Cimacium* 2 parts, the body of the Column makes 3 parts; the upper *Cimacium* 1 part, the under-*Cimacium* is 45 minutes: There hath the *Plinth* 30 minutes; the other members in 15 minutes, divided into $3\frac{1}{4}$ parts; the upper *Cimacium* is $22\frac{1}{2}$ minutes divided in $5\frac{1}{2}$ parts; the *Base* is one half model, divided in $5\frac{1}{2}$ parts; the Liſt upon the *Base* is $\frac{2}{3}$, or 2 minutes, and ſtands off from the Column: on the left ſide is the Ornament and Capital; the Capital is one half model high, divided in $11\frac{1}{2}$ parts; and the like part hath the *Aſtragal*: the Ornament is $\frac{1}{4}$ of the height of the Column, and is 2 models $7\frac{1}{2}$ minutes divided in $18\frac{1}{2}$; thereof give the Architrave 5 parts, is 35 minutes divided in $7\frac{1}{2}$ parts; the Frieſe $6\frac{1}{3}$ parts, is 45 minutes; the Liſt above the Frieſe $\frac{2}{3}$ is 5 minutes; the Corniſh 6 parts 42 minutes, divided in $6\frac{1}{2}$ parts.

parts (the Author gives $6\frac{1}{4}$ parts) that it may come forth more: in the Cornish must come in 10 Dentils, besides the Gripe that hangeth on each side.

XIII.

Here is shewn the great and small Impost with his Arch and Ornament of the Principal Gate of the *Doric* Order: On the right side is the Impost and Arch, the Impost and the Arch of the smaller Bow, standing below, marked with the Letter K: the Impost is $27\frac{1}{2}$ minutes high, divided in $8\frac{1}{2}$; a like part hath also the Astragal of the Impost; the small Arch or Bow is $27\frac{1}{2}$ minutes, divided in $6\frac{1}{2}$ parts; the height of the Impost Major or greater Impost, is 30 minutes, divided into $9\frac{1}{2}$ parts; the great Arch or Bow is 34 minutes high, divided in $6\frac{1}{2}$ parts: On the left side is the Ornament of the principal Gate; and is high 1 model $23\frac{1}{2}$ minutes, whereof the Architrave hath $27\frac{1}{2}$ minutes, divided in six $\frac{1}{2}$ parts; the Frieze is $22\frac{1}{2}$ minutes; the Cornish is $23\frac{1}{2}$ minutes, divided in $4\frac{1}{2}$ parts.

XIV. of

XIV.

Of the IONICK Order.

IF you would make the *IONICK* Gallery without the Pedestal, then must you divide the whole height in $10\frac{1}{2}$ models; to make the Work shew the more stately; and under it make one gross Base of half a model high, and of four Columns breadth must be 10 models and $21\frac{1}{2}$ minutes; whereof the middle inter-Column must have $2\frac{1}{2}$ models; the inter-Columns that stand on the right and left side must be 1 model $55\frac{1}{2}$ minutes; on the middle of each Column and the Pilaster must be one modillion; in the outermost inter-Columns shall be 5 spaces, in the middlemost 6 spaces; the four Columns have from the middle of the first to the middle of the last Column 16 spaces and modillions: but if men will make them of 6 Columns, then must they divide the breadth in $16\frac{1}{2}$ models, and there comes on the 6 Columns between the modillions 26 spaces; and of eight Columns must the breadth be 22 models, and there comes on the 8 Columns 36 spaces between the modillions: the height of the lights of the Doors is $\frac{2}{3}$ of the height of the Column, with his Architrave and Frieze above the modillions, and the light comes to 5 models and $\frac{1}{2}$; the breadth of the lights of the doors comes to 2 models $48\frac{1}{2}$ minutes; the Ornament must be $\frac{1}{4}$ and $\frac{1}{2}$ of the height of the lights of the doors, and is 1 model and 18 minutes, divided in 15 parts; give 5 to the Architrave, 4 the Frieze, 6 the Cornish; and the Architrave is $26\frac{3}{4}$ minutes, the Frieze 20 minutes, the Cornish $31\frac{1}{4}$ minutes.

XV.

The minor or smaller *Ionick* Arch must be wide from one Pilaster to the other 3 models 50 minutes, and must stand more than one half out of the Pilaster; the Pilaster is 30 minutes under on the breadth of the Column; the Impost is high $28\frac{1}{2}$ minutes, divided in $9\frac{1}{2}$ parts; such like parts hath also the Astragal there under the height of the Arch or Bow $24\frac{1}{4}$ minutes, divided in $7\frac{1}{4}$ parts; the Key-piece in the Arch is 50 minutes high; the Arch is higher than one half Circle 12 minutes; the height from above the Impost to the under-edge of the Base, is 6 models and 18 minutes.

XVI.

The *Ionick* Gallery with the Pedestal, the whole height of the Column must be 13 models, and the 4 Columns breadth must be $12\frac{2}{3}$ models, whereof the middle inter-Column must be $3\frac{2}{3}$ models; the inter-Column on the side must be $2\frac{1}{2}$ models; on the four Columns, from the middle of the first, to the middle of the last Column, cometh 20 spaces and modillions, of 6 Columns breadth is $19\frac{2}{3}$ models, and hath 32 spaces between the modillions; and of 8 Columns breadth is $26\frac{2}{3}$ models, and hath 44 spaces between the modillions: the light of the door is $\frac{2}{3}$ from the under-edge of the Pedestal of the Column, Architrave and Frieze, to the upper-edge of the modillions, and is 7 models 17 minutes; the breadth of the door of the lights is 3 models $30\frac{2}{3}$ minutes; the Ornament must be $\frac{1}{4}$ and $\frac{1}{2}$ of the height of the lights of the doors, and is $1\frac{1}{8}$ model divided in 15 parts; give 5 to the Architrave, 4 the Frieze, 6 the Cornish; the Architrave is $32\frac{1}{2}$ minutes, the Frieze 26 minutes, the Cornish 39 minutes.

XVII. H

XVII.

If you would make the *Ionick* Arch with the Pedestal, then must the distance from one Pilaster to the other be 4 models and 50 minutes; the height from the under-edge of the Pedestal, to the upper-edge of the Impost, is 7 models and 35 minutes; the Impost is $50 \frac{1}{4}$ minutes high; the Arch or Bow $30 \frac{1}{2}$ minutes; the corner-piece 1 model; the Arch is higher than one half Circle 15 minutes; the height of the lights of the door is 6 models $16 \frac{1}{2}$ minutes; the breadth of the lights is 3 models and 2 minutes; the Ornament is high 1 model $25 \frac{1}{2}$ minutes; the Architrave hath $28 \frac{1}{2}$ minutes; the Frieze hath $22 \frac{1}{2}$ minutes; the Cornish $34 \frac{1}{2}$ minutes; the Pilaster is 35 minutes broad under on the Column.

XVIII.

Here is shown the particular members of the *Ionick* Column: On the right side you have the Pedestal and Base; the Pedestal is $3 \frac{1}{2}$ of the height of the Column, and comes to $2 \frac{1}{2}$ models, which divided into $6 \frac{2}{3}$, thereof give the under-*Cimacium* 2 parts, the Trunk or the Neck $3 \frac{1}{3}$; the upper-*Cimacium* is 1 part, the under-*Cimacium* 45 minutes; thereof give the Plinth 30 minutes, the other 15 minutes, divided in $4 \frac{1}{4}$ parts; the upper-*Cimacium* is $22 \frac{1}{2}$ minutes divided in $6 \frac{1}{2}$ parts; the Base is half a model, divided in $5 \frac{1}{2}$ parts; on the Column be two members, divided out with the aforesaid parts, is $3 \frac{2}{3}$ minutes: On the left side is the Capital and Ornament; the Capital is $31 \frac{1}{2}$ minutes high of the under-edge of the Scroll, or more; the Astragal on the upper-edge of the *Abacus* is $18 \frac{1}{2}$ minutes, divided in $7 \frac{1}{2}$ parts: The Ornament is $1 \frac{1}{4}$ model high, and is $\frac{1}{4}$ of the height of the Column, divided in 15 parts, give the Architrave 5, the Frieze 4, the Cornish 6, the Architrave 5 parts and 35 minutes, divided in $8 \frac{1}{4}$ parts; the Frieze is 28 minutes, and must have one List on of $\frac{1}{4}$ part, such like part as the Cornish hath of $1 \frac{1}{2}$ minute; the Cornish is 42 minutes, divided in $7 \frac{1}{2}$ parts, and $\frac{1}{2}$ twelfth part, or in $7 \frac{1}{4}$ parts; but if you are to make great or Royal Work, then commonly is the Frieze carved: So must

the Ornament be between $\frac{1}{4}$ and $\frac{1}{3}$ part of the height of the Column, and divided in $16\frac{2}{3}$ parts; give the Architrave 5 parts, the Frieſe $5\frac{1}{3}$, the Corniſh 6 parts.

XIX.

Here is ſhewn the great and ſmall Impoſt with his Arch and Ornament of the principal Gate of the *Ionick* Order: On the right ſide is the Impoſt and Arch, the Impoſt and the Arch of the ſmall Bow, ſtanding beneath the Impoſt, is $28\frac{1}{2}$ minutes high, divided in $9\frac{1}{2}$ parts; ſuch like parts hath alſo the Aſtragal: The Arch or Bow is $24\frac{1}{4}$ minutes, divided in $7\frac{1}{4}$ parts; the great Impoſt, is high $50\frac{1}{4}$ minutes, divided in $8\frac{1}{4}$ parts; the great Arch or Bow is high $30\frac{1}{2}$ minutes, divided in $7\frac{1}{2}$ parts: On the left ſide is the Ornament of the Principal Gate, and is high 1 model $25\frac{1}{2}$ minutes; the Architrave is high $28\frac{1}{2}$ minutes, divided in 7 parts; the Frieſe is high $22\frac{2}{3}$ minutes; the Corniſh is high 34 minutes, divided in $5\frac{1}{4}$ parts; under and above the Frieſe is one fillet of $\frac{1}{4}$ part of the aforeſaid parts.

XX.

Of the ROMAN Order.

IF you would make the *ROMAN* Gallery without the Pedestal, then must you take the height of $11 \frac{2}{3}$ models, and make one gross Base under of $\frac{1}{2}$ model high; and of 4 Columns breadth must be 9 models 40 minutes, whereof the middle inter-Column must have $2 \frac{1}{4}$ models; the inter-Column standing on the right and left side, must be 1 model 42 $\frac{1}{2}$ minutes: On the middle of each Column must come one Modillion; and in the outer inter-Column must come 5 spaces; in the middle inter-Column 6 spaces: the 4 Columns have from the middle of the first to the middle of the last Column 16 spaces and Modillions; but if you make them 6 Columns, then must the breadth be $15 \frac{1}{2}$ models, and there comes on the 6 Columns between the Modillions 26 spaces; and of 8 Columns the breadth must be $20 \frac{1}{2}$ models, and there comes on the 8 Columns 36 spaces between the Modillions: the height of the lights of the doors is $\frac{2}{3}$ of the height of the Column with his Architrave and Frieze: from the upper edge of the Modillions, and the lights, is of 6 models 30 minutes; and the breadth of the lights of the doors, of 3 models 25 minutes: The Ornament must be $3 \frac{1}{4}$ parts of 15 parts of the height of the lights, and is 1 model 24 $\frac{1}{2}$ minutes divided in 15 parts; 5 for the Architrave, 4 the Frieze, 6 the Cornish; and the Architrave is $27 \frac{1}{2}$, the Frieze 22, the Cornish 33, without the *Gola* and *Orle*, the which next belongs to the Cornish of the Frontispiece.

XXI. The

XXI.

The small *Roman* Arch must be from one Pilaster to the other 4 models and 34 minutes; and must stand somewhat more than half out of the Pilaster: the Pilaster is 28 minutes; under on the breadth of the Column, the Impost is high $31 \frac{1}{2}$ minutes, divided in $11 \frac{1}{2}$ parts: such like parts hath also the Astragal: there under the height of the Arch or Bow is 28 minutes, divided in $7 \frac{2}{3}$ parts; the Key-piece in the Arch is high 50 minutes; the Arch is higher than one half-Circle 14 minutes; the height from above the Impost, from the under-edge off from the Base, is 6 models 54 minutes.

XXII.

The *Roman* Gallery with the Pedestal, the Column must be 14 models 42 minutes high; and the breadth of 4 Columns must be 11 models and 50 minutes; whereof the middle inter-Column must be $3 \frac{1}{3}$ models: the inter-Column on the side 2 models 15 minutes: On the 4 Column from the middle of the first, to the middle of the last Column cometh 20 spaces and Modillions; of 6 Columns breadth is 18 models and 20 minutes, and hath 32 spaces between the Modillions; and of 8 Columns breadth is 24 models and 50 minutes, and hath 44 spaces between the Modillions: the lights of the doors is high $\frac{1}{2}$ from the under edge of the Pedestal with his Column; the Architrave and Frieze to the upper edge of the Modillions, comes to 8 models $12 \frac{2}{3}$ minutes; the breadth of the lights of the doors is 3 models $53 \frac{1}{2}$ minutes; the Ornament must be $\frac{3}{4}$ and $\frac{1}{4}$; for the Architrave, Frieze, and Cornish of the height of the lights of the doors, and comes to 1 model and 53 minutes, divided in 15 parts; give 5 to the Architrave, 4 the Frieze, 6 the Cornish; and the Architrave is $37 \frac{2}{3}$ minutes, the Frieze $30 \frac{1}{2}$ minutes, the Cornish is $45 \frac{1}{2}$ minutes.

XXIII. IF

XXIII.

If you make the *Roman Arch* with the Pedestal, then must the distance from one Pilaster to the other be $5 \frac{1}{2}$ models; the height from the under-edge of the Pedestal to the upper-edge of the Impost, is 8 models $42 \frac{1}{2}$ minutes; the Impost is high $55 \frac{1}{2}$ minutes; the Arch or Bow is 33 minutes; the Corner-piece is 1 model high; the Arch is higher than a half-Circle $17 \frac{1}{2}$ minutes; the lights of the Doors is 7 models 18 minutes high: the breadth of the Lights is 3 models $26 \frac{1}{2}$ minutes: the Ornament is high 1 model 24 minutes; thereof the Architrave hath $31 \frac{1}{3}$ minutes; the Frieze is $25 \frac{1}{2}$ minutes; the Cornish is $37 \frac{1}{2}$ minutes: the Pilaster under on the Column is $32 \frac{1}{2}$ minutes broad; the Architrave $31 \frac{1}{3}$ minutes, divided in $7 \frac{2}{3}$ parts; the Cornish is $37 \frac{1}{2}$ minutes, divided in $5 \frac{3}{4}$ parts; about the Frieze is one List of $\frac{1}{4}$ part that goes off from the Frieze.

XXIV.

Here is shewn the particular members of the *Roman Column*: On the right side you have the Pedestal and Base: the Pedestal is $\frac{3}{4}$ of the Column's height, and comes to 3 model; which divided in 8 parts, give thereof the under-Cimacium 2 parts, the neck 5 parts, the upper Cimacium 1 part, the under Cimacium 45 minutes: thereof give the Plinth 30 minutes, the other 15 minutes, divided in $4 \frac{1}{2}$ parts; the neck of the Pedestal is high $1 \frac{2}{3}$ model, and the breadth is 1 model 24 minutes; the upper Cimacium is $22 \frac{1}{2}$ minutes, divided in $6 \frac{2}{3}$ parts; the Base is $\frac{1}{2}$ model, divided in 6 parts: On the Column be two members, and are to be divided out with the aforesaid parts $3 \frac{3}{4}$ minutes. On the left side is the Capital and Ornament; the Capital is high 1 model and $\frac{1}{6}$, or 70 minutes, which divided in $23 \frac{1}{3}$ parts, to make the ground of the Capital, take 1 Square of $1 \frac{1}{2}$ model, each side of the Square draw one round Circle of $\frac{2}{7}$ of a model, or 51 minutes, or so thick as the Column is above, and all the other jettings over the like, as be made in *Corinthi*; but the Scrolls are made after the *Ionic* manner: The Ornament is 1 model 57 minutes,

minutes and is $\frac{1}{2}$ of the height of the Column, divided in 15 parts; thereof give the Architrave 5 parts, the Frieſe 4 parts, the Corniſh 6 parts; the Architrave 5 parts is 39 minutes, divided into 9 parts; the Frieſe $31 \frac{1}{3}$ minutes; the Corniſh $46 \frac{2}{3}$ minutes, divided in $7 \frac{1}{2}$ and a half part, or in $7 \frac{3}{4}$.

XXV.

Here follows the great and ſmall Impoſt with his Arch and Ornament of the principal Gate of the *Roman Order*: On the right ſide is the Impoſt and Arch; the Impoſt and Arch of the ſmall Bow ſtanding beneath; the Impoſt is high $31 \frac{1}{3}$ minutes, divided in $11 \frac{1}{2}$ parts; ſuch like part hath alſo the Aſtragal; the Arch or Bow is high 28 minutes, divided in $7 \frac{2}{3}$ parts; the great Impoſt is high $55 \frac{1}{2}$ minutes, divided in $8 \frac{1}{4}$ parts; the great Arch or Bow is high $33 \frac{2}{3}$ minutes, divided in $7 \frac{2}{3}$ parts. On the left ſide is the Ornament of the principal Gate, and is high 1 model 24 minutes; the Architrave is high $31 \frac{1}{3}$ minutes, divided in $7 \frac{2}{3}$ parts; the Frieſe is high $25 \frac{1}{2}$ minutes; the Corniſh is high 37 minutes and $\frac{1}{2}$, divided in $5 \frac{2}{4}$ parts; under on the Frieſe is one liſt of $\frac{1}{4}$ part and $\frac{1}{2}$ minute.

XXVI.

Of the CORINTHIAN Order.

IF you will make the *CORINTHIAN* Gallery without a Pedestal, then must you divide the whole height in 12 models, and you shall place under it one gross Base of one half model high, and of the 4 Columns breadth must be 9 models; whereof the middle inter-Column must have 2 models: they that stand on the right and left side must have the inter-Column of $1\frac{1}{2}$ model; on the middle of each Column and Pilaster must be one modillion; in the outermost inter-Column shall be 5 spaces, and in the middle 6; the 4 Columns have from the middle of the first to the middle of the last Column 16 spaces and modillions: but if you make them of the breadth of 6 Columns, then must you divide the breadth into 14 models; and there comes on the 6 Columns between the modillions 26 spaces; and of the 8 Columns the breadth must be 19 models, and there comes on the 8 Columns 36 spaces between the modillions: the height of the Lights of the Doors is $\frac{2}{3}$ of the flat of the Column that come under the spaces of the modillions, or in 6 parts under to the Architrave; and the Light is of $6\frac{2}{3}$ models; the breadth of the Lights is 3 models and 5 minutes; the Ornament must be $\frac{1}{3}$ of the height of the Light, and divided likewise in 15 of the like parts; give 5 to the Architrave, 4 the Frieze, and 6 the Cornish; and the Architrave is $26\frac{2}{3}$ minutes, the Frieze $21\frac{1}{3}$ minutes, the Cornish 32 minutes: So the whole Ornament is 1 model 20 minutes.

XXVII.

The small *Corinthian* Arch must be 4 models 8 minutes wide from one *Pilafter* to the other, the *Pilafter* is 26 minutes broad under on the *Column*, the *Impost* is $33 \frac{1}{2}$ minutes high, divided in $7 \frac{1}{4}$ parts: the height of the Arch or Bow is 25 minutes, divided in $9 \frac{1}{2}$ parts; the *Key-piece* in the Arch is 50 minutes high; the Arch is higher than one half-Circle 16 minutes; the height from above the *Impost* to the under-edge off of the *Base*, 7 models and 20 minutes.

XXVIII.

The *Corinthian* Gallery with the *Pedestal*, the *Column* must be $15 \frac{1}{2}$ models high; and the breadth of 4 *Columns* 11 models; whereof the middle inter-*Column* must be 3 models; the inter-*Column* on the side must be 2 models: On the 4 *Columns* from the middle of the first, to the middle of the last cometh 20 spaces and *Modillions*, of 6 *Columns* breadth is 17 models, and hath 32 spaces between the *Modillions*; and of the breadth of 8 *Columns* is 23 models, and hath 44 spaces between the *Modillions*: the *Light* of the door is $\frac{2}{3}$ of the under-edge of the *Pedestal* with his *Column* to the upper-edge of the *Modillion*, and is 8 models $32 \frac{1}{2}$ minutes high; the breadth of the *Lights* of the door is 3 models $59 \frac{1}{2}$ minutes; the *Ornament* must be $\frac{1}{2}$ of the height of the *Lights* of the doors, and is 1 model $42 \frac{1}{2}$ minutes, divided into 15 parts; thereof the *Architrave* hath 5 parts, and the *Frieze* 4, and the *Cornish* 6; and the *Architrave* is 34 minutes, the *Frieze* 27 minutes, the *Cornish* is 41 minutes.

XXIX.

If you will make the *Corinthian* Arch with the Pedestal, then must the distance from one Pilaster to the other be 5 models; the height from the under-edge of the Pedestal, to the upper-edge of the Impost, is $9\frac{1}{2}$ models; the Impost is high $55\frac{1}{2}$ minutes; the bigness of the Arch must be $\frac{1}{10}$ of the breadth, like the foregoing Arch, and is 30 minutes; the Corner-piece 1 model; the Arch is higher than one half Circle 20 minutes; the height of the Lights of the door is 8 models, and the breadth of the Lights of the door is 3 models 45 minutes, the Ornament is high 1 model 36 minutes; the Architrave hath 32 minutes, divided in $9\frac{1}{2}$ parts; the Frieze is $25\frac{1}{2}$ minutes, and hath one list of $\frac{1}{4}$ part under the Cornish; the Cornish is $38\frac{1}{2}$ minutes, divided in $5\frac{2}{3}$ parts; the Pilaster under on the Column is 30 minutes broad.

XXX.

Here followeth the particular members of the *Corinthian* Column: On the right side you have the Pedestal and Base; the Pedestal is $\frac{1}{3}$ of the height of the Column, and is $3\frac{1}{2}$ models, which divided in $\frac{2}{3}$ 8 parts, thereof give the under-*Cimacium* 2 parts, the Neck of the Pedestal $5\frac{2}{3}$ parts; the upper-*Cimacium* 1 part, the under-*Cimacium* is 45 minutes; thereof give the Plinth 30 minutes, the other member is 15 minutes, divided in $4\frac{1}{8}$ parts; on the *Cimacium* is also two members, one *Torus* of $\frac{3}{4}$ and one list of $\frac{1}{3}$: of the aforesaid parts, the upper-*Cimacium* is $22\frac{1}{2}$ minutes, divided in $7\frac{3}{8}$ parts, there under is one list of $\frac{1}{8}$ parts goes off from the neck; the Base is one half model, divided in $6\frac{1}{2}$ parts, and must go off the shaft of the Column $\frac{1}{2}$ part and a $\frac{1}{2}$ part: On the left side is the Ornament and the Capital; the Capital is high 1 model $\frac{1}{6}$ or 70 minutes, which divided in $23\frac{1}{3}$ parts; the Astragal is $1\frac{2}{3}$ of the parts of the Capital: The Ornament is $\frac{1}{2}$ part of the Columns height, and is 2 models; this divided in 15 parts, give 5 the Architrave,

4 the Frieſe, 6 the Corniſh; the Architrave is 40 minutes divided in $12 \frac{1}{2}$ parts; the Frieſe is 32 minutes, the Corniſh is 48 minutes, divided in $7 \frac{3}{4}$. So much it projects, and is juſt $7 \frac{1}{2}$ parts.

XXXI.

Here followeth the great and ſmall Impoſt with his Arch and Ornament of the principal Gate of the *Corinthian* Order: On the right ſide is the Impoſt and Arch, the Impoſt and Arch of the ſmall Bow ſtands marked wth the Letter K; the Impoſt is high $33 \frac{1}{2}$ minutes, divided in $7 \frac{1}{2}$ parts; The ſmall Arch or Bow is high 25 minutes, divided in $9 \frac{1}{2}$ parts; the height of the great Impoſt is 55 $\frac{1}{2}$ minutes, divided in $7 \frac{3}{4}$; the great Arch or Bow is 30 minutes, divided in $9 \frac{1}{2}$ parts: On the left ſide is the Ornament of the principal Gate, and is high 1 model 36 minutes; thereof the Architrave hath 32 minutes, divided in $9 \frac{1}{2}$ parts; the Frieſe is 25 minutes; the Corniſh $38 \frac{1}{2}$ minutes, divided in $5 \frac{1}{2}$ parts.

XXXII.

Here is ſhewn how you ſhall leſſen the Columns; the *Tuſcan* Column is $\frac{1}{4}$ ſmaller above than beneath; the *Doric* $\frac{1}{5}$; the *Ionick* $\frac{1}{6}$; the *Roman* or *Compoſita* is $\frac{1}{7}$; the *Corinthian* is $\frac{1}{8}$: which are to be divided in 12 equal parts, 3 of which muſt go up in a ſtraight line in the *Tuſcan* Column; of the *Ionick* $3 \frac{1}{2}$ goes up in a ſtraight line, and the *Corinthian* 4 parts goes ſtraight up; of the *Doric*, and *Roman* or *Compoſita*, is a meaſure between the *Tuſcan* and *Ionick*, and between the *Ionick* and *Corinthian*; the other leſſenings men may eaſily ſee how they ſhall make them in the Figure here ſet down.

XXXIII. Shews

XXXIII.

Shews how you may make the *Corinthian* Base, and the upper and under *Cimacium*, with his Diagonal lines for enlarging the Projecture.

XXXIV.

Sheweth how the *Corinthian* Ornament is to be made, as the Architrave, Frieze and Cornice with his Diagonal lines for enlarging the Projecture, easie to be understood; so draw one Diagonal line after a perfect quadrate of the whole Projecture of the Cornice; and in these Diagonal lines must all the Perpendicular lines come for the members that are in the Projecture; and this outermost end must we then after this measure draw with the said Diagonal, so that in the crossing, you make right Angels, that the height of the drawing members be parrallel near to the Diagonal.

XXXV.

This is the Ornament of the *Corinthian* Order of the principal Gate, and is 1 model 36 minutes high, (as before is declared) thereof the Architrave hath 32 minutes; the Frieze 25 $\frac{1}{2}$ minutes; the Cornish 38 $\frac{1}{2}$ minutes; the Architrave 32 minutes, divided into 9 $\frac{1}{2}$ parts; thereof sticks farther out as the outer-edge of the Door-stile 7 $\frac{1}{2}$ parts, or 8 $\frac{1}{2}$ minutes farther for Cornishing; and let the ears of the Architrave be 17 parts long; of the fore-given parts, or 55 $\frac{1}{2}$ minutes to underneath, besides all other the Cornishing of the Architraves, as you may see in the Figure; the Frieze is 25 $\frac{1}{2}$ minutes, divided in 7 parts for making the *Voluta* or Scroll, and draw one line up: the fourth part, or 14 $\frac{1}{2}$ minutes from above off right Parallels; so there remains 3 parts or 11 minutes for the standing out beneath, and the eye of the Scroll is $\frac{1}{7}$ part, or 3 minutes and $\frac{2}{4}$ of the

the height of the Frieſe; and draw a Line perpendicular from above to the under-edge of the ear of the Architrave, and where the lines cut croſs each other, here is the middle of your eye: ſtrike out the croſs 4 parts $16\frac{1}{2}$ minutes near to the outſide, and $3\frac{1}{2}$ parts, or $12\frac{1}{2}$ minutes to the inſide, and draw your Scroll then after this manner here drawn: the Scroll or *Voluta* beneath is $\frac{1}{4}$ part $5\frac{1}{2}$ minutes ſmaller, as the upper-Scroll is, and is high 20 minutes, and the breadth $12\frac{1}{2}$ minutes: divide the height in 8 parts, and draw a Parallel-line of $4\frac{1}{2}$ parts, or $11\frac{1}{4}$ minutes from beneath to above, and there the Parallel-line cut croſs the Perpendicular is the middle of the eye, ſtrikes out croſs $3\frac{1}{2}$ parts, or $8\frac{3}{4}$ minutes to above, and 4 parts or 10 minutes to the outſide; and there remains over 5 parts, or $12\frac{1}{2}$ minutes to the inſide; farther all that belongs to it may you in the Figure here plainly ſee; as for the breadth of the Scroll is $2\frac{1}{8}$ parts of the Cornices given parts, or 19 minutes; the other members before may be ſeen in the Figure.

XXXVI.

Here is ſhown two Chimney-mantils, with their Profile.

XXXVII.

Here is ſhown the ground of the Building of the Lord *Strozzi* ſtanding at *Florence*, the like is deſcribed in the Authors third Book in the ſeventh Chapter.

XXXVIII.

The half of the Building on the ground to be ſeen inwards of the Building of the Lord *Strozzi*.

XXXIX. The

XXXIX.

The other half with the up-rising to be seen with the foreside of the foresaid Building.

XL.

Here we have the under-side of the Cornice of all the five Columns; *A* of the *Tuscan*, *B* of the *Dorick*, *C* the *Ionick*, *D* the *Roman* or *Composita*, *E* the *Corinthian*.

F I N I S.

Advertisement.

THe Description and Use of the Carpenters Rule, together with the Use of the Line of Numbers, and its application in measuring all Superficies and Solids; Gauging with the use of a sliding Rule, and the Joynt-Rule, by *John Browne*, and sold by *William Fisher*.

XXXXX

1813

Advertisement

The undersigned has the honor to acknowledge the receipt of a sum of money from the Treasurer of the United States, for the purchase of land, and to certify that the same has been duly received and applied to the purpose for which it was intended.

T H E
Description and Use
Of an Ordinary
JOINT-RULE
Fitted with
L I N E S

For the ready finding

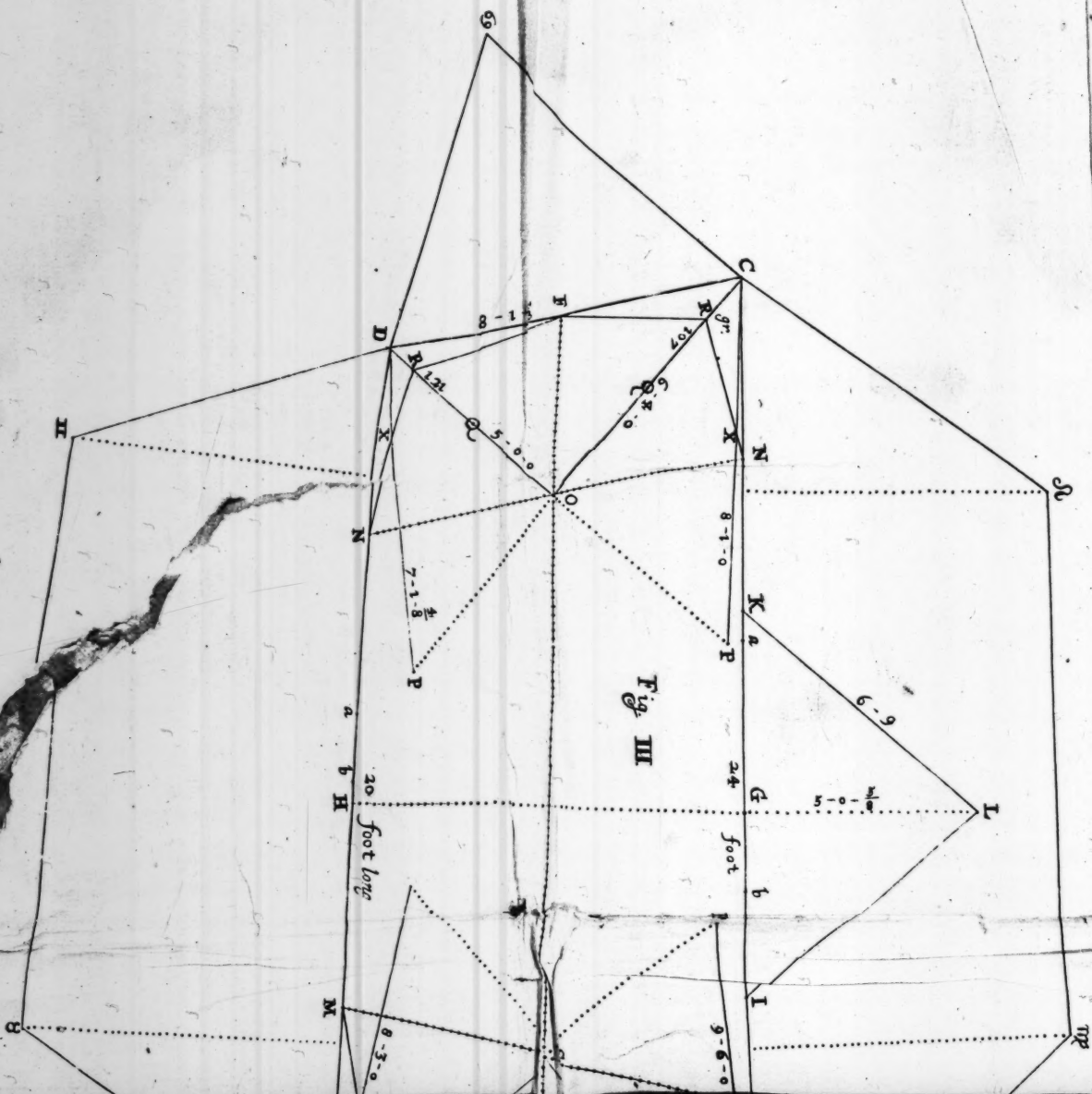
The Lengths and Angles of Rafters and Hips, and
Collar-Beams in any Square or Beveling Roofs at any Pitch,
and the Ready Drawing the Architrave, Frieze and Cornice
in any Order.

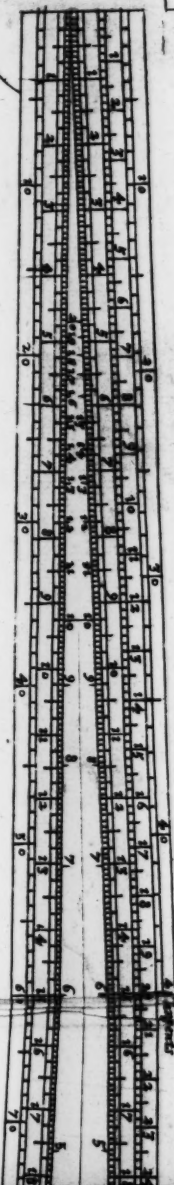
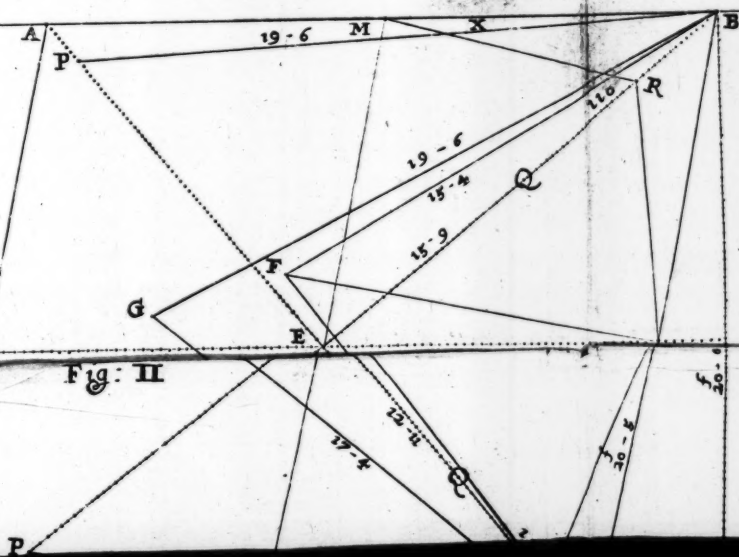
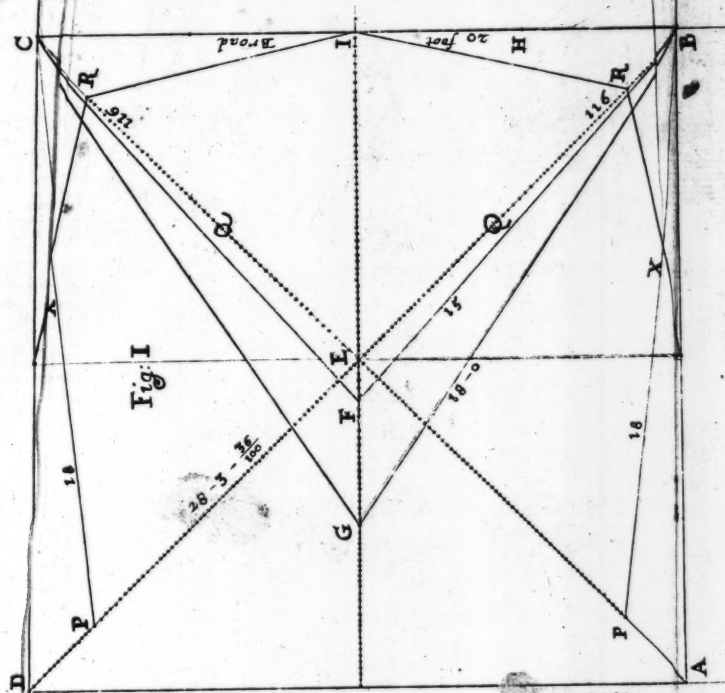
W I T H
Other Useful Conclusions by the said Rule.

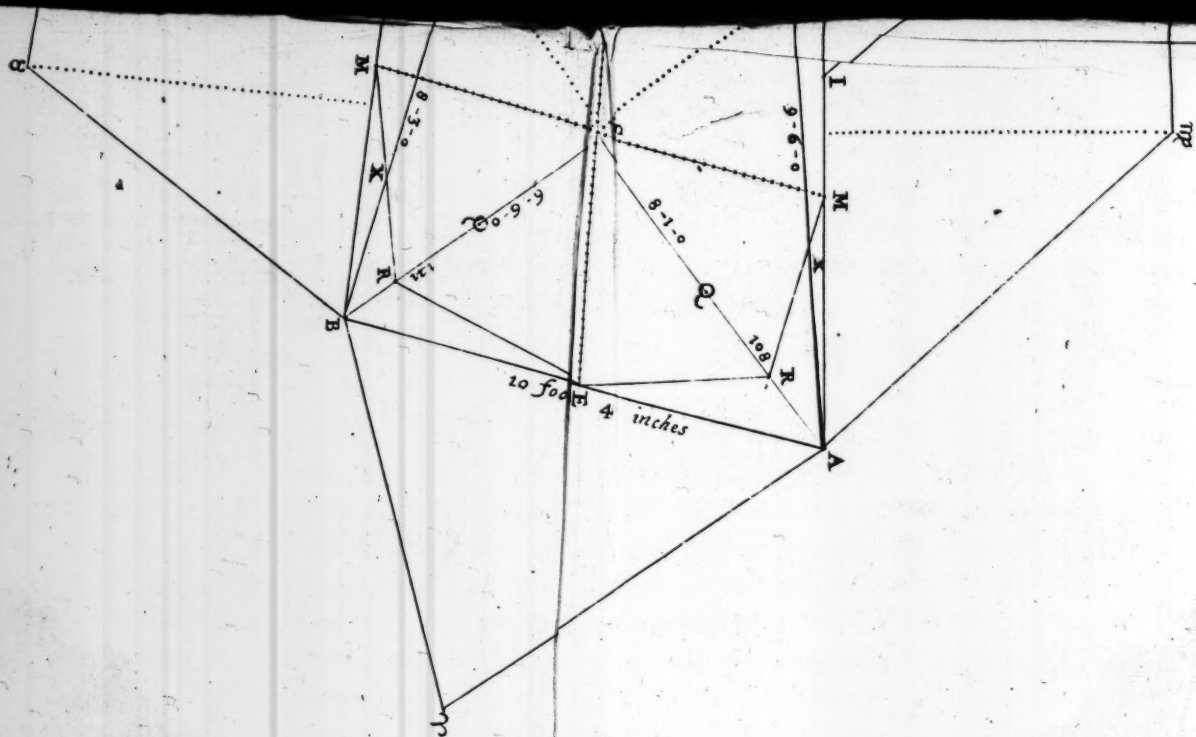
B Y
J O H N B R O W N E.

L O N D O N :

Printed in the Year MDCLXXXVI.









The Description and Use of a Joint-Rule fitted with Lines for the ready finding the Lengths and Angles of Rafters, Hips and Collar-Beams in any Square or Bevelling Roofs at any Pitch.

First, The Rule is an ordinary Jointed Rule of a Foot long when shut together, or two Foot being opened to a straight Line. And the Lines delineated thereon for this purpose, are

1. First, a Line of Lines, drawn Sector-wise from a Center on both Legs of the Rule, but continued to 30 at the end in stead of 10 the old usual manner, and every single Integer of the 30 is divided into 12 parts, to represent every particular Inch of the 30 Foot according to the common reckoning by Feet and Inches.

2. There is another Scale of Equal parts also, of the same length lying as near to the other of 30 as may be, on one Leg only, which is divided into 40 parts, to represent 40 Feet; and each of those 40 Feet, parted into 6 parts to represent every two Inches only, because the room for one Foot, will not admit of more parts.

3. In the same place on the other Leg is divided a Line of natural Sines and Tangents to 45, but numbered as a Line of Chords to 180 Degrees, to set the Rule to, or to find the quantity of any Angle, in the proper terms of expression (all the world over) degrees and minutes.

4. On the innermost Line of the 10 Scale that runs to the Center is set 20 prick, beginning at 2 at the Center-pin at 30, and so proceeding with 3, 4, 5, and 6 at the Center-pin at 15, and then 7, 8, 9, 10, and so forwards to 20, towards

The Description and Use

the Center; which serves to divide a Circle into any number of parts, very useful and ready in the practice of Drawing or Architecture.

Thus much for Description; the Uses follow.

The Uses of this Line of Lines; or Scale of equal parts to 30, drawn from the Center, is of a general and manifold use: as Mr. Gunter in his Book of the Sector hath shewed.

A brief touch whereof take in the first place, as by the way, and then the use of the Rule to the business intended.

And for the better doing hereof, it is needful to explain three or four terms, for the avoiding of many words, and needless repetitions in this brief, yet plain Discourse.

1. First, by the word Lateral is meant any distance taken, either in Feet and Inches, on the 30 Scale, or degrees and minutes on the Chords, taken and counted from the Center, in the midst of the head of the Joint-Rule along any one Leg: as thus, Suppose I would take out 15 Foot Laterally, set one point of the Compasses in the Center at the head, and open the other to 15 on any one Leg on the 30 Scale; this extent I call a Lateral Extent of 15 Foot. Also if you take the Lateral Chord of 60 Degrees, you shall find the extent of the Compasses from the Center to 60 to be the same as from the Center to 15 Foot, on the 30 Scale of Feet and Inches.

2. By the word Parallel, I mean any distance taken, by setting one point of the Compasses in any number of Feet and Inches on one Leg, and the other point in the same, or any other number on the other Leg, across from one Leg to the other; as thus the Rule being opened, then the extent of the Compasses from 20 on one Leg, to 20 on the other Leg, is a Parallel extent.

3. In all Parallel Extents, you must set one point of the Compasses in the Common Line on one Leg, to the Common Line on the other Leg, which Common Line is that only of the 30 Scale which runs to the Center, in which the Center-pins at 15 and 30 are.

4. The nearest distance from a point to a Line is only thus; Set one point of the Compasses in the point given, and open or shut the other being turned about, till the other will but just touch or cleave the Line, that I call the nearest distance.

of a Joint-Rule.

3

Use I.

To lay down a Line, that shall represent any Number of Feet and Inches given or required.

Take the Number given laterally from the 30, or 40 Scale from the Center, and that is the Line required.

But if these Scales are too great, or too small, then take your Number of parts, and the length thereof Laterally.

As for Example; suppose I would have 3 Inches to represent 30 Foot, take out 3 Inches between your Compasses, and make it a parallel in 30 and 30, and the 30 Scale is set to your desire.

Use II.

To increase or diminish a Line to any Proportion.

Take the given Line between your Compasses, and make it a parallel in the parts thereof; then the parallel extent of the parts you would have it increased, or diminished to, is the Augmentation, or Diminution, which was required.

Example, Let 3 Inches represent 8 Foot, and to the same proportion I would have 10 Foot, or 5 Foot, viz. more or less.

Take 3 Inches between your Compasses, and make it a parallel in 8, and 8 on the 30 Scale; then the parallel distance between 5 and 5, doth diminish the Line, and the parallel between 10 and 10 doth increase the Line to the proportion required.

Use III.

To divide a Line into any Number of parts

or models under 30.

Take the given Line, and make it a parallel in the parts on the 30 Scale into which you would have it divided; then the parallel extent between 1 and 1 shall divide the Line accordingly.

Example, Let 4 Inches be a Line to be divided into 9 parts, take 4 Inches, (or any distance whatsoever) and make it a parallel

The Description and Use

rallel in 9 and 9 on the 30 Scale; then the parallel distance between 1 and 1 shall divide 4 Inches into 9 parts required: Note, that for more exactness and conveniency, you may Double 9, or Triple 9, viz. 18, or 27, and then if you make the Line to be divided, a parallel in Triple the Number you must take out 3 in stead of one, and that shall divide the Line into the parts required.

Example, I would have 5 Inches put into 10 parts, take 5 Inches between your Compasses, and make it a parallel in 30, and 30 the Triple of 10, then take out parallel 3, and 3 the Triple of one: and that shall divide the Line given being 5 Inches into 10 parts or models exactly: the like for any other. And note, as the Rule stands you may take out any number of parts or models whatsoever, to that Scale.

Use IV.

Any two Lines given, to find their Proportion one to another according to any other Number.

Take the Lines severally, and lay them Laterally from the Center, on the 30 or the 40 Scale, which you please; and the Numbers of Feet and Inches, to which they reach, shall shew their proportion one to another of the parts of the Line on which they are measured.

Example, I have 2 Lines, suppose one is 2 Inches long, and the other 5, or any other unknown part.

Take 2 Inches the measure of one Line, and measure it Laterally on the 30 Scale, and it gives 5 Foot $\frac{1}{2}$ an Inch, then take out 5 Inches the supposed length of the other Line, and it gives Laterally 12 Foot 8 Inches; then I say one Line is 5 Foot and half an Inch, and the other is 12 Foot 8 Inches of a Scale of 30 Foot in 11 Inches 3 quarters length.

Or if you conclude on the Term or number of one Line, then make that Line a parallel in the parts thereof, then take the other Line, and carry it parallelly till it stay in like parts, on both Legs in the common Line, and that shall be the Denomination of the other Line.

of a Joint-Rule.

5

Uſe V.

Two Lines being given, to find a Third in continual Proportion to them.

Take both the Lines, and lay them laterally on both Legs, and note the Feet and Inches to which they do extend as in the laſt.

Then take out the lateral extent of the ſecond Line, and make a parallel in the terms of the firſt Line, keeping the common Line at that opening, then the parallel extent from the terms of the ſecond Line, ſhall be the lateral 3d Term or Line in Proportion.

Example, Suppoſe I have one Line 3 Foot long, and another 5 Foot, and I would have another to bear proportion to 5, as 3 doth to 5 increaſing, being in numbers thus; as 3 is to 5, ſo is 5 to what? Here note that 3 is the firſt number, and 5 the ſecond.

The firſt Line laid from the Center, on the 30 Scale, extends to 7 Foot 7 Inches, and 5 Inches; the ſecond Line gives 12 Foot 8 Inches.

Now the lateral ſecond Line, viz. 5, or 12 Foot 8 Inches, made a parallel 7 in Foot 7 Inches, the terms of the firſt Line, then take out the parallel extent from 12 Foot 8 Inches (the meaſure of 5) and it ſhall give 2 1 Foot 1 Inch laid laterally from the Center, for a third Proportional required; which, meaſured on the Inches, is 8 Inches and a third, the answer required; for as 3 is in proportion to 5, ſo is 5 to 8, and a third part.

But by the Line of Numbers, having the quantity of the Lines given in Numbers, do thus:

The extent of the Compaſſes from the firſt Number 3, to the ſecond Number 5, ſhall reach the ſame way from the ſecond Number 5, to 8. 33 the third proportional Number required.

Uſe VI.

To divide a Line in ſuch ſort as another Line is divided.

Take the whole Line that is divided, and lay it laterally on both Legs, and fit the Line that is to be divided parallelly in the ends thereof, then lay every part of the divided Line laterally

The Description and Use

rally in like manner, as the whole Line was laid, and the parallel extent between those parts shall divide the Line accordingly : as for Example ;

Suppose I would divide a Line of 8 Inches $\frac{1}{2}$ long in such sort as the Line of Circles on the inside of the 30 Scale is divided.

Take out 8 Inches $\frac{3}{4}$, and make it a parallel in 2 and 2, the divided Line, then take out the parallel distance from 3 and 3, and that shall give the point 3 from the end of the Line you would divide, and so consequently all the rest in order, as far as you please.

Use VII.

To find a mean Proportional between two Lines or Numbers.

Open the 30 Scale to a right Angle, by making lateral 2 1 Foot 2 Inches a parallel in 15 Foot.

Then find the Sum and half Sum, the Difference and half Difference, between your two Numbers ; and having the half Sum between your Compasses, set one Point to the half Difference counted laterally on one Leg ; and wheresoever the other Point shall touch the common Line on the other Leg, is the mean Proportional required.

Example, Suppose a piece of Timber be 10 Inches one way, and 18 inches another, what is the Square equal, which is the mean Proportional between them ? the sum of 10 and 18 is 28, the half sum is 14 ; the Difference between 10 and 18 is 8, the half Difference is 4. Now the 30 Scale standing Square, taking 14 the half Sum between your Compasses, and then set one Point in 4 on one Leg, and turn the other Point of the Compasses toward the common Line, and there it shall shew 13 $\frac{1}{2}$ near the Square equal required.

Use VIII.

To work the Rule of Three by the Line of Lines to 30 or to 3 Numbers given to find a fourth, in Geometrical Proportion Direct.

Make the lateral second a parallel in the first, then the parallel third shall give the lateral fourth number required.

Example,

of a Joint-Rule.

7

Example, If one Foot of Timber cost 10 *d.* what shall 6 Foot cost? *facit* 60 *d.*

Make Lateral 10 a Parallel in 10 counted as 1, then the Parallel extent between 6 and 6 shall reach to Lateral 60, the Answer required (in pence.)

Again, another Example:

If 50 Foot, or a Load of Timber cost 44 *s.* what shall one Foot cost?

Take the Lateral Extent from 22 the half of 44 *s.* and make it a Parallel in 25 the half of 50, then the Parallel distance between 2 and 2 counted as 4 Foot shall give the Lateral Number of 3 *s.* 6 *d.* the price of 4 Foot, whose fourth part is 10 *d.* $\frac{1}{2}$ the price of one Foot. Note this help is used, to avoid the nearness to the Center where the work is inconvenient.

Use IX.

To measure flat Measure by the Scale of 30.

At any Inches broad to find how much in length makes a Foot.

Take Lateral 12, make it a Parallel in the breadth given, then take out Parallel 12 again, and it shall give the length of a Foot required.

Example, At 9 Inches broad, as Lateral 12, to Parallel 9, so is Parallel 12, to Lateral 16, the length required.

Use X.

The breadth of a Board given in Inches, and the length in Feet, to find the Content in Feet and Inches required.

Take the Lateral Length in Feet, and make it a Parallel in 12, then the Lateral distance, between the Inches broad, shall give the Parallel Content.

Example, Of 15 Foot 3 Inches long, and 9 Inches broad.

Take Lateral 15 Foot 3 Inches, and make it a Parallel in 12, then take out Parallel 9 and 9, and it shall give Lateral 11 Foot and a half the Content.

C

Use

The Description and Use

Use XI.

To measure Timber by the Line of Lines to 30.

At any Inches Square to find how much makes a Foot of Timber.

If the Piece be not Square, then by the eighth Use make it Square : Then thus ;

Take the Lateral Side of the Square in Inches, make it a Parallel in 12, then take out the Parallel Side of the Square, and it shall give a Lateral 4th Number.

Then take out Lateral 12, and make it a Parallel in the 4th Number, and then take out Parallel 12 again, and it shall shew the answer in Inches laid Laterally from the Center.

Example. At 9 Inches Square what makes a Foot ?

As lat. 9. to par. 12, so is par. 9. to lat. $6\frac{3}{4}$: Again,

As lat. 12 to par. 4th, viz. $6\frac{3}{4}$, so is par. 12, to 21 Inches $\frac{1}{2}$ the length to make one Foot required.

Use XII.

The Inches, Square, and Length given in Feet, to find the Content in Feet and Inches.

As the Lat. Side of the Square to Parallel 12, so is the par. lenth to lat. 4th : Again,

As the Lat. 4th to parallel 12, so is the par. side of the Square to Lateral Content.

Example, at 9 Inches Square and 20 Foot long.

As lat. 9 to par. 12, so is par. 20 to lat. 15, a 4th number : Again,

As lat. 15 the 4th to par. 12 ; so is parallel 9 to lat. $11\frac{1}{4}$, the Content required.

Thus much for the General Use, being too long a Digression from the matter mainly intended.

Use

of a Joint-Rule.

Use XIII.

The Breadth of any Frame being given, to find the Length of the Rafter and Perpendicular by Inspection only.

In being a General received Rule, that the Length of the Rafter should be three-quarters the breadth of the House, (or Frame) for true pitch, and 40 the Feet in one Scale, being equal in length to 30 the Number of Feet in another Scale, and 30 being 3 quarters of 40. Therefore,

If you seek for the breadth of the House on the 40 Scale, then right against it, on the 30 Scale, is the length of the Rafter required. Also if you seek the length of the Rafter on the 40 Scale, on the 30 Scale, right against it, is the height of the Perpendicular required, *viz.* from the Rafting-piece to the top of the Gable end or Rafter required.

Example, If a House be 30 Foot broad, the Rafter ought to be 22 Foot 6 Inches, and the Perpendicular 16 Foot 9 Inches and $a \frac{1}{2}$; for right against 30, counted on the 40 Scale, on the 30 Scale is 22--6 the Rafter, and right against 22--6 on the 40 Scale on the 30 is 16--9 $\frac{1}{2}$ the Perpendicular.

1. Also by the Line of Numbers, the Extent of the Compasses, from 20 to 15, will reach the same way from the Breadth of any House to his proportionable Rafter at true pitch.

2. And the Extent from 20 to 18, turned the same way from any Breadth of a House to his proportionable Hip-Rafter, in square Frames.

3. Also the Extent from 20 to 11 $\frac{1}{5}$, will reach the same way from the width of any House to his proportionable Perpendicular, at square and true pitch.

4. And the Extent from 20 to 28--28, will reach from any other House Breadth to his proportional whole Diagonal Line required, at square and true pitch.

5. And the Extent from 20 the breadth to 26--63 the nearest distance at that breadth, shall reach from any other breadth to his proportional nearest distance required, if it were needful. But the Angles in all Roofs great or small, if true pitch and square, are the same in all Frames.

Use XIV.

The Breadth of the House and the Height of the Perpendicular being given to find the Rafter Length, the Hips Length, the Diagonal Line, from Corner to the King-post, and any Angle required, in square Frames. What the Perpendicular Height of the Gable end ought to be at true pitch by the last Rule you may readily see, and the better make estimate of the quantity of alteration. Which being once resolved on, then thus proceed.

First open the two 30 Scales to a Right Angle by making Lateral 21 Foot 2 Inches $\frac{1}{2}$ a parallel in 15, and 15 in the brass Center-pins.

Rafter,
Hips.

1. Then count half the Breadth of the House on one Leg, and the Length of the Perpendicular resolved on, on the other Leg, then the parallel distance between them, measured Laterally from the Center, shall give the true Length of the Rafter required.

2. For the Hips Length count the Length of the Rafter last found on one Leg, and the half Breadth of the House on the other Leg, and take the parallel distance between, and measure it from the Center Laterally, and it shall be the true Length of the Hips required.

Diagonal.]

3. For the Diagonal Line, count the half Breadth of the House on both Legs, and take the parallel distance between, and measure it from the Center, and it shall be the Length of the Diagonal Line, from the Corner to the King-post.

Hips Length.

4. Again for the Hips count the Diagonal Line last found on one Leg, and the Perpendicular height on the other Leg, and the parallel distance between shall be the Hips true Length measured as before from the Center.

Example. In a House of 20 Foot wide at true pitch. See Fig. 1. let ABCD represent a Frame of a House 20 Foot wide, BI the half width, BA and CD equal to BC the whole width being 2 points to draw the Diagonal Lines by. IE being equal to IB, and the half EI laid from E to G gives IG the true Length of the Rafter, and GB or GC the Length of the Hips.

Or thus, Three quarters of CB, viz. CH gives CF and BF the Rafter Length; the same extent also laid upon the middle

the Line from I to G, gives CG and BG the Hips Length, IF is the Perpendicular Height, E is the Point of the Diagonal Line or King-post, perpendicularly opposite to or right under the meeting point of the 2 Hips, and the 2 Rafter when raised and set in their places.

Thus much for Illustration what to do, now for Application how to do.

The Width of the House is always given, the Length of the Rafter, or the Height of the Perpendicular is next resolved on, which in our Example being true pitch is also resolved on, either by Inspection as before, or else by operation in this manner.

1. The Breadth of the House being 20 Foot, and the Perpendicular resolved on to be 11 Foot 2 Inches $\frac{1}{2}$. To find the Rasters Length, work thus,

Open the 30 Scale to a Right Angle (by Use the seventh) count 10 the half Breadth of the House on one Leg, and the Perpendicular Height 11 $2\frac{1}{2}$ on the other Leg, (viz, both on the 30 Scale from the Center) and take the parallel distance between them, (on the common Line) and measure it from the Center, and it shall give just 15 Foot the Length of the Raster required CF. For the Rasters Length.

2. But if according to the Width of any Frame, you resolve on the Rasters Length, and would have the Perpendicular Height of the Gable end, then thus:

Count the Length of the Raster from the Center, and take the Lateral Extent thereof (being 15) between your Compasses, the Compasses being so set, set one point in 10 the half Width of the Frame, and turn the other point parallelly to the common Line, and there it shall shew 11 Foot 2 $\frac{1}{2}$ Inches, the true Height of the Perpendicular at true pitch required. IF 11 Foot 2 Inches $\frac{1}{2}$. For the Perpendicular.

3. For the Length of the Hips, Count the half Breadth of the House on one Leg, and the Rasters Length on the other Leg, and take the parallel distance between, and it shall give the true Length of the Hips required. As here, the parallel distance between 15 and 10, shall be Lateral 8, the true Length of the Hips required in a Square Frame 20 Foot wide true pitch. CG. For the Hips Length.

4. For the Diagonal Line from the Corner to the King-post. Count

The Description and Use

Half the Diagonal Line.

Count the half Width of the House, viz. 10 Foot on both Legs, and take the Parallel extent between, and it shall reach from the Center to 14 Foot 1 Inch $\frac{1}{2}$ being the Line C E in the Figure.

Hip.

5. Otherwise for the Hips Length, Count the half Diagonal on one Leg 24 $1\frac{1}{2}$ and the Perpendicular 11 Foot 2 In. Inches 2; on the other Leg, and the Parallel distance between, measured from the Center, will give the true Hips length 18, viz. the Line C G.

Thus much for the Rafters and Hips in Square Frames at true pitch, the measure of whose Angles and Lengths are as followeth,

	F. Inc. 180 parts	F. 100 parts.	deg. min.
C F Rafter	15 00 00	15 000	Raf. } Top 41 50
C G Hip	18 00 00	18 000	ter } Foot 48 10
I F Perpendicular	11 02 17	11 180	Hips } Top 51 38
BE Diagonal	14 01 68	14 140	Foot 38 22
BI Half Breadth	10 00 00	10 000	
BC Whole breadth	20 00 00	20 000	Difference 13 16
KG Nearest Dist.	16 07 50	16 624	
BD Whole Diag.	28 03 36	28 281	Outsid. ang. 116 12

The breadth of the house being 20 f. and the two ends square, and the Rafters at true pitch, the Lengths and Angles of the Frames, are

The Rule to find the Angles of the Rafters and Hips.

1. For the Angles that the Rafters make at Foot and Head, with the Raising-piece, and King-post, do thus,

When the Rule stands square in the 30 Scale, then lay any streight piece to the Compass points, when one stands in the half breadth, and the other point in the Perpendicular; then if you apply a Bevel severally, to that streight edge, and the 30 Scale at each end, the one is the Angle at Foot 48--10, and the other the Angle at Head, viz. 41--50.

2. For the Angle at Head or King-post, and Foot of the Hips, do thus; the 30 Scale being set square, set one point of the Compasses in the half Diagonal-line; on one 30 Scale, and the other point in the Perpendicular on the other 30 Scale, and to those points lay any streight piece, then set a Bevel

Bevel to that Streight piece, and each 30 Scale, and the one shall be the Angle at Foot 38--22, and the other the Angle at the Head, viz. 51--38; then this last Angle doubled, and the difference between the Angle at head and foot, viz. 13--16 added, makes 1:6--12 the Angle of the outside of the Hip-Rafter, in a square frame at true pitch required.

3. A General way to find this outward Angle of the Hip or Mould is thus, in any pitch.

First, you must find the nearest distance from one Corner to the opposite Hip set up, or from a point in the raising piece, as far from one Corner as the House-end is broad, as the point K or L in the Figure may be done thus.

Count the length of the Hip on one Leg, (and also take it between your Compasses) and count the breadth of the House on the other Leg, and set one point of the Compasses in the Hips length on one Leg, and the other point in the breadth of the House on the other Leg, altering the 30 Scales, but not your Compasses; then when the 30 Scales are so set, one represents the Raising-piece, and the other the Hip set up.

Then the nearest distance from the breadth of the House on one 30 Scale, to the Common-line on the other 30 Scale, is the nearest distance required, being measured from the Center, 16-7- $\frac{1}{2}$.

Then take the whole Diagonal Line, viz. CL, or BK from the Center Laterally, and make it a Parallel, in the nearest distance last found; and that shall set the 30 Scales to the Angle of the outside of the Hip required, which you may measure in degrees thus: take Parallel 15 as the Rule stands, and lay it from the Center, and it shall reach to 116 Degrees on the Chords, next one 30 Scale, the Angle of the outside of the Hips required.

Example, and more briefly in a House 20 Foot broad.

The House-end is 20 Foot broad, the whole Diagonal Line is 28 Foot 3 Inches $\frac{3}{8}$, the Hip-Rafter 18 Foot.

Take 18 Foot between your Compasses, and set one point in 20, and open or shut the Rule till the other fits 18, then

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then the nearest distance from 20 to the Common-Line will be 16 Foot 7 Inches $\frac{1}{2}$.

Then take 28 Foot 3 Inches $\frac{1}{2}$, the whole Diagonal Line, and make it a parallel in 16 Foot 7 Inches $\frac{1}{2}$ the nearest distance, and the 30 Scales are set to the Angles required: For,

If you take out Parallel 15 the Chord of 60, and measure it laterally from the Center, it shall reach to 116, the Angle in Degrees and Minutes required.

Note, If the whole breadth and whole Diagonal Line is too large for your Compasses, then the half breadth and half Diagonal will do as well, (taking the half length of the Hip also between your Compasses, and on the Scale also) and that shall set the Scales to the same Angle as before.

Use XV.

To find the Lengths and Angles of the Rafters and Hips, or Sleepers, in Beveling Frames at any Pitch.

Rafter.

1. For the length of the Rafter, set the 30 Scales square, then count the half length of the Bevel-end on one Leg, (being always more there than the half breadth) and the Perpendicular resolved on, on the other Leg: Then the Parallel distance between, measured laterally, shall be the length of the Rafter required, and a Ruler laid to the two Points of the Compasses so set on the 30 Scales, and a Bevel set, as before in Square Frames is shewed, shall give the Angles at head and foot required.

Hips.

2. For the Hips length, count the Rafters length on one Leg, and the half breadth of the Bevel-end of the House, more by half the number of Inches bevelling on the other Leg, and take the Parallel distance between, and measure it laterally from the Center, and it shall be the length of the longest Hip-Rafter. And for the shortest Hip count less than the Bevel-end, by half the number of Inches bevelling, and that shall be the short Hip required.

Angle of the Frame.

3. The Inches, or Feet and Inches of Bevelling being given, to find how much one corner is under, and the other over 90 Degrees (or just Square) open the 30 Scales, and take the breadth of the House over at the nearest distance, between your

your Compasses, from the 30 Scale from the Center laterally, and make it a Parallel in 15 and 15 for 60 of the Chords.

Then take the Feet and Inches Beveling from the same 30 Scale laterally, and carry it Parallelly till it stay in like parts; then just against it on the Degrees or Tangents are the Degrees and Minutes required, that one corner is more, and the other less than 90 Degrees.

4. *To find the Diagonal Line.*

Take the distance in the Chords to the Degrees above, or under 90 last found, from the Center laterally, and make it a Parallel in 15 and 15, and then the 30 Scales are set to the Angle; the end is over, or under 90 Degrees: Then count the whole or half Bevel-end on both Legs, and the Parallel distance between shall shew the length of the whole, or half Diagonal Line measured from the Center. Diagonal-lines.

Note, That when the Rule stands at the Blunt Angle, it gives the longest Diagonal Line; and when it stands at the Sharp Angle, it gives the shortest Diagonal Line.

5. *By the Diagonal Line and Perpendicular to find the Hips Length, and the Angles at Head and Foot of the Hip or Sleeper.*

Count the half Diagonal on one Leg, and the Perpendicular Hips height on the other Leg, (the 30 Scales being Square) then the Parallel distance between, shall be the length of the Hip required, being longer or shorter, as the Diagonal Line is.

Also a Rule laid to the two points of the Compasses measuring the Parallel Extent, and a Bevel laid to the Rule, and the two Angles of the 30 Scales, at each end, gives the Angles at head and foot of Hips. Hips required.

To find the nearest Distance from the Corner of the Rombus to the opposite Hip set up in his true place.

6. Count the length of the Hip on one 30 Scale, and take that

D

that

Nearest Distance.

that distance also between your Compasses laterally, count also on the other 30 Scale the length of the Bevel-end, and there set one point of the Compasses, and open or shut the Rule, till the other point falls in the length of the Hip-Rafter first counted (then one 30 Scale represents the Raising-piece, and the other the Hip set up) then the nearest distance from the breadth of the Frame over, at the Bevel-end and more, or less, by half the Feet and Inches Bevelling, to the Common Line of the other 30 Scale, being measured from the Center shall be the nearest distance required.

To find the Angle on the outside of the Hip.

7. To find the Outside Angle of the longest Hip, Take the shortest Diagonal Line between your Compasses, and make it a Parallel in the nearest distance belonging to that Hip, and the 30 Scales will be set to the Angle required, and to measure it take Parallel 15 and 15, and measure it laterally from the Center in the Chords; and you shall have the measure of the Angle required.

Example; In a House of 20 Foot over at nearest distance, and 4 Foot or 48 Inches Bevelling out of Square. See Fig. II.

Let ABCD represent a Frame 20 Foot over, and 4 Foot Bevelling, the Bevel end BC is longer than right over by 5 Inches; for if you set the Rule square, and take the Parallel extent from 20 the measure over, to 4 Foot the measure of Bevelling, and measure it Laterally, you shall find it reach Laterally to 20 Foot and 5 Inches, the true length of the Bevel-end.

The Bevel-end being 20, 5 Inches the Perpendicular resolved on, which at true Pitch ought to be about 11 Foot 5 Inches fere. Then first for the Rafter's Length.

1. Set the 30 Scales square, and set one point in 11, 5 the Perpendicular, and the other point in 10 Foot $2\frac{1}{2}$ the half Bevel-end; (and to the Compass-points, lay a Rule, and to the Rule and the 30 Scales at both ends set a Bevel, and one shall be the Angle at foot, and the other at the Angle at the top of the Rafter: And the one Angle will be 42 Degrees for the Foot, and the other 48 for the top of the Rafter) and the measure between

Rafter's Length and Angles.

between the Compasses measured from the Center shall be 15 Foot 4 Inches, the Rafter's Length required.

As by Inspection on the 40 and 30 Scales you may see.

2. For the longest Hip set one point in 12 Foot 2 Inches and $\frac{1}{2}$ more by two Foot, than 10 Foot 2 Inch: $\frac{1}{2}$ the half Bevel-end, and the other point in 15, 4 the Rafter's length, and measure it from the Center, it gives 19 Foot 6 Inches the longest Hip.

Again, Set one point in 8 Foot 2 Inches $\frac{1}{2}$ 2 Foot shorter than Hips Length. the half Bevel-end, by 2 Foot the half of 4 Foot the Bevelling, and the other point in 15 Foot the Rafter's length, and measure it from the Center, it gives 17 Foot 4 Inches the length of the shortest Hip.

3. For the length of both Diagonal Lines, set the Scales of 30 to the Angle of the Frame at each corner, and the measure from the half, or the whole Bevel-end taken Parallely, shall be the length required of the half or whole Diagonal Line, according as you take the whole or half Bevel-end.

As here in our Example the Blunt-end is 101 gr. 30 min. Diagonal-lines. or 11 30 more than 90 gr. therefore take the distance from the Center to 101, 30 on the Chords, and make it a Parallel in (15 and 15) the Chord of 60, then is the 30 Scales set to the Angle of the Blunt-end of the Frame, and the Parallel distance between 20-5 the whole Bevel-end gives 31 Foot 6 Inches, the whole Diagonal Line, B L, or the Parallel between 10 2 $\frac{1}{2}$ give 15-9 Inches B E the half.

Again, The sharp end is 78, 30 11 degr. 30 less than 90, then the lateral Chord of 78, 30 made a Parallel Chord of 60 (at 15) then is the Rule set to the sharp end of the Frame, for the shorter Diagonal Line. And the Parallel distance between 10-2 $\frac{1}{2}$ gives 12 Foot 11. the half, or 25 Foot 10 Inches the whole Diagonal Line C F, whose half is C E the shortest whole and half Diagonal Lines.

4. For the Hips Length, and Angles at Foot and Head.

Set the 30 Scales square, and count the shortest half Diagonal 12 Foot 11 on one Leg, and the Perpendicular 11 Foot 5 on the other Leg, then the Compass points so set, lay a Rule Hips Length. and take the Bevel at both ends, and it shall give the two Angles at head and foot of the shortest Hip, and the same distance

Hips Length of the Compass points shall be 17 Foot 4 Inches *ferè*, the Hip-length, as before, and the Angle at the top 48 30, and at Foot 41 30 his Complement.

Again, Set one point in 15 Foot 10 the longest half Diagonal, and the other point in 11 Foot 5 Inches the perpendicular, and lay a Rule to them, and set the Bevel to both ends, and you shall find 54 gr. the Angle at the top, and 36 the Angle at foot, and the distance between the Compasses laid from the Center, gives 19 Foot 6 Inches the longest Hip.

5. For the Outside Angles of both Hips, the longest first.

Take 19 6 between your Compasses the Hips length from the 30 Scale: Set one point in 20 Foot 5 the Bevel-end, and close the Rule till the other point touches 19, 6 the Hips length.

Outside Angle
of long Hip.

Then take the nearest distance from 18 Foot 5 [2 Foot less than 20 Foot 5 the breadth of the Bevel-end of the Frame] to the other 30 Scale, and it is the nearest distance from the point of the *Rombus* A to the Hip BG set up, 15 Foot 9 Inches.

Then take out 25 Foot 10 the shortest Diagonal. and make it a Parallel in 15, 9 the nearest distance, and then the 30 Scales are set to the Angle required, for the Outside of the Long Hip being 110 degrees for parallel 15 measured laterally on the Chord, gives 1100.

6. For the Outside Angle of the shortest Hip.

Outside Angle
of short Hips.

Take 17 Foot 4 Inches between your Compasses, and set one point in 20 Foot 5 the Bevel-end, and open or shut the Rule till the other point reaches 17 4 on the other 30 Scale. Then the nearest distance from 22 Foot, 2 Foot more than the breadth of the Bevel-end of the Frame to the Common Line on the other 30 Scale, and that shall be the nearest distance from L to CG the shortest Hip set up, which is 18 Foot 9 Inches.

Then take out 15 Foot 10 Inches the half greater Diagonal Line, (because 31 Foot 8 Inches is more than the Scale of 30) and make it a Parallel in 9 00 the half of 18 Foot, and the 30 Scales are set to the Angle required, *viz.* 122 degrees; for if you take out Parallel 15, and measure it in the Chords laterally, it shall be 122 the Angle required.

Note here by the way, the length of the Bevel-end, and the two Diagonal Lines, and the halves of them, and the blunt and sharp Angles of the Frame, are given by the draught of the

the Frame, and they being first known, the work is half done; but if not given, then use these Directions, which will help you to see the reason of plain Triangles, and the use of the Scales.

Use XVI.

To find the Rafter, Hips and Angles in Bevel and Taper Frames, being broader at one end than the other. See Fig. III.

First, when the Frame is broader at one end than the other, then the middle breadth is to be the guide for the Rafter Length, and the Perpendicular to be equal to the middle Rafter perpendicular on both ends; though one pair of Rafter is longer than another, and the Roof in winding thereby: Which winding may many times be remedied by some convenient artifice or other, as the ingenious Workman will soon perceive. As thus in brief:

Let *ABCD* represent the Frame of a House Beveling at both ends, and broader by 2 Foot at one end than the other; as here in the Beveling figure, being 20 Foot on one side, and 24 Foot on the other side at one Bevel-end 10 Foot 4 Inches, and at the other end 8 Foot 1 Inch $\frac{1}{2}$, but at the nearest distance over, only 10 Foot and 8 Foot.

First, for your more apparent satisfaction, draw the true form of the Frame by as large a Scale as you conveniently can, with the Sides and Angles as exact as you can, as *ABCD*; then draw the middle Line *EF* quite through the length, and *GH* through the breadth of the Frame Perpendicular one to the other; then measure *GH* as suppose 9 Foot, then lay off the half of *GH* from *H* to *I* and *K*, then take out $\frac{1}{2}$ of *GH*, and lay it from *K* and *I* to *L* 6 Foot 9 Inches for a pair of middling Rafter for this Taper-House, *LG* being the common Perpendicular at the middle and both ends of the Roof, 5 Foot 0 Inch $\frac{1}{8}$ of an Inch.

And for the principal Rafter, or other Rafter, open the 30 To find the Length of the very principal (or single) Rafter in a Taper Frame.
Scale square, and then count the Perpendicular 50 $\frac{1}{8}$ on one Leg, and half the distance between the Rafter-feet or half breadth of the Frame at that place on the other Leg; and the Parallel distance between shall be the true Length of the Rafter required.

Then

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Then for the Hips Length, first make A M and B M equal to A E or B E at one end, and make C N and D N equal to D F or C F, and draw the Lines M M and N N at both ends, also make A b and B b equal to A B, and C a and D a equal to C D, and draw the Diagonal Lines A S and B S, and C O and D O at each end extended, and set down the measures of them.

These Lines being drawn, you have the half Diagonal Lines A S and B S, and C O and D O, and may measure them by your Scale, to find their Lengths, or set the Rule to the Angles A E S and B E S, find them by the 30 Scale; also you have the Bevel-ends of the Frame, and the nearest distance over from side to side of the Frame.

Then for the Hips Length and Angles thus,

Set the 30 Scales square, and count the Perpendicular Height L G on one Leg 5 Foot 0 $\frac{1}{2}$ and each half Diagonal Line, &c. one after another on the other Leg, and the Parallel distance between shall be the true Length of the several Hips required: Example.

The Parallel distance between 5 Foot 0-Inches $\frac{1}{2}$ the common Perpendicular counted on one 30 Scale, and 8 Foot 1 Inch, the longest Diagonal Line A S counted on the other 30 Scale shall give 9 Foot 6 Inches for the Length of one Hip A P laterally.

And the Parallel distance between 5 Foot 0 $\frac{1}{2}$ the common perpendicular, and 6 Foot 6 Inches the other Diagonal Line B S shall give the lateral measure of 8 Foot 3 Inches, the length of B P, the other Hip-Rafter for the broadest end of the Frame A B.

Again, the Parallel distance between 5 Foot 0 $\frac{1}{2}$ the common Perpendicular, and 6 Foot 4 Inches the great Diagonal Line, C O at the narrowest end shall give 8 Foot 1 Inch for the Hip-Rafter C P. And the Parallel distance between 5 Foot 0 $\frac{1}{2}$ the Perpendicular, and 5 Foot 0-Inch 0 the lesser Diagonal Line D O shall give 7 Foot 2 Inches for the Hips length D P to stand over the Diagonal Line D O.

Note also, that if to the Compass points standing parallelly you lay a Rule, and to the Rule (so laid) and the 30 Scales
at

at each end a Bevel, and set it according to the Rule and 30 Scales, it shall give the true Angle of the Hips at the Raising-piece and King-post, which 8 Angles in these 4 Hips are exprest by the Lines and Letters in the Scheme thus: PAS and PBS, PDO and PCO the 4 Angles at the Raising-piece. And SPA and SPB, OPC and OPD the 4 Angles at the King-post.

Whose length you may prove by Mr. Pope's excellent way, making SP and OP equal to LG on the extended Diagonal Line, and drawing the Lines AP, BP, CP, DP, for the 4 Hip-Rafters length required.

Or for more proof thus also by the Rule, as before in Square Roofs.

Set the 30 Scales Square, and take the Parallel Extent, from 7 Foot $2\frac{1}{2}$ the Rafters length at the broader end, on one 30 Scale, to 6 Foot 2 Inches more, then $\frac{1}{2}$ the Bevel-end by 1 Foot the half quantity of Bevelling, and it shall give 9 Foot 6 Inches for the Hip AP, and from $7-2\frac{3}{4}$ to 4-2, one Foot less than the half Bevel-end, to 8 Foot $\frac{1}{4}$ the Hip BP. Also the Par. extent from 6 Foot $5\frac{1}{2}$ the Rafters Length at the lesser end, to 5 Foot $0\frac{3}{4}$ one Foot more than $4-0\frac{1}{4}$ the half little Bevel-end, shall give 8 $1\frac{1}{2}$ for the Hip PC. And the Extent, from $6-5\frac{7}{8}$ the Rafters length, to $3-0\frac{3}{4}$ 1 Foot less than the half Bevel-end, gives $7-1\frac{1}{2}$ the Hip DP, as before.

Note, That by the working these 3 ways, you may be sure to prevent any mistakes that may happen in working one way only.

Lastly, For the Angles on the outside or backs of the Hips.

Take every several Hips Length laterally between your Compasses, and set one Point in the Length of the Bevel-end, (or rather in a mean between AB the Bevel-end, and MM at the greater end, or CD and NN at the lesser end) and open or shut the 30 Scales till the other Point falls on the Hips Length that you work for, then for the longer Hip count more, and for the shorter Hip less, by half the Inches Bevelling, then the whole breadth over, at the end, and take the Parallel nearest distance from thence to the 30 Scale for a nearest distance, which nearest distance you must keep.

Then take the whole Diagonal Line Perpendicular to the Hip,

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Hip, wrought for (*viz.* the shortest Diagonal Line for the longest Hip at each end) between your Compasses, and make it a Parallel in the nearest distance last found, and then the 30 Scales are set to the Angle of the back of the Hip required.

Example in this Figure for the longest Hip.

Take 9 Foot 6 Inches, the Hips Length A P between your Compasses, and set one point in 10 Foot one Inch (a mean between AB 10 Foot 4, and M M 9-10 $\frac{1}{2}$) and open or shut the Rule, till the other point stands in 9 Foot 6, the Hips length first taken. Then the nearest distance from 9 Foot 4 Inches, one Foot less than 10 f. 4 Inch. the Bevel-end distance over, to the other 30 Scale shall give 7 10 a nearest distance from the point b to A P the Hip raised over A S the Diagonal.

Then the Lateral Extent B b of the whole Diagonal Line 12 f. 7 Inch. being made a parallel in 7 10 the nearest distance last found, shall set the 30 Scales to the Angle at R the back of the Hip required measured by taking Parallel 30, and measuring at laterally on the Chords it is about 168 Degrees.

Secondly, Take 8 f. 4 Inches, the other Hips Length between your Compasses, and setting 1 point in 10 f. 1 Inch as before, open or shut the Rule till the other point falls in 8, 4 the Hips Length.

Then the nearest distance from 11 Foot 4 Inches, 1 Foot more than 10 Foot 4 Inches the distance of the Bevel-end to the Common Line of the other 30 Scale shall be when measured Laterally from the Center 9 Foot *fers*, for a nearest distance.

Then 15 Foot 8 Inches the longer Diagonal Line being made a Parallel in 9 Foot *fers*, the nearest distance last found, sets the 30 Scales to 121 Degrees the Angle required, the back of the shorter Hip required.

The same work serves for the other end, being near the same Angles: Which you may prove by M. Will. Pope's excellent way, thus: find the middle between Sand A, or S and B at Q, then the nearest distance from Q to B P or A P near lay to R, and draw the Lines R E, R M for the Angles at R the back of the Hips required.

Moreover, if you raise 4 Perpendiculars cutting the Points O and S, the two places of the King-posts being perpendicular to the Raising-pieces A C and B D, as the 4 Prick-lines

lines \propto S, \propto S, \propto O, and \propto O do shew, and lay the length of each Hip from his proper corner ABCD as AP from A to \propto and \propto . BP from B to \propto and \propto , DP from D to \propto and \propto , CP from C to \propto and \propto , then draw lines from point to point, as in the Figure.

Then \propto \propto and \propto \propto are the two Ridges when turned right over OS, and C \propto D is the least Hip, and A \propto B is the greater Hip, as Mr. Pope hath well shewed. Thus much for Hipt Roofs.

Use XVII.

To find the Length and Angles of every Principal particular Rafter in Frames broader at one end than the other.

The Perpendicular, as before was hinted, is to be the same all over the Roof. Therefore open the Rule Square, and take from the Perpendicular on one Leg, to the half breadth of the Frame on the other Leg, measure it from the Center, and that is the Length required. For the Angles lay a Rule to the Compass-points, and set a Bevel, as before is shewed, and you have the Angles at the Raising-piece, (and Ridge of the House) to cut the Rasters feet by.

The same Rule serves to draw out a pair of Well-Stairs, to give Hypothenuæes, or strings, at any particular height and breadth; for the 30 Scales set Square, and the Perpendicular height counted on one Leg, and the breadth on the other Leg, the measure between is always the Hypothenuæa, or string in flying Stairs, as may plainly appear.

Use XVIII.

To find the Length and Angles of Collar-Beams in any Roof.

Take the whole breadth of the Frame between your Compasses, and set one point in the Length of the Rafter on one Leg, and the other point in the same place on the other Leg: then the two Legs represent the two Principal Rasters, and a Rule laid to the Compass-points represents the Raising-piece; then at any height that you please above the Raising-piece,

E

apply

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apply a Rule parallel to it, and the measure between laid from the Center, gives the length, (remembring to add wood for the Tenons) and a Bevel laid to the 30 Scale, and Rule, gives the true Angle to cut it by, (where the Timbers be Square.)

use XIX.

*To find the Lengths and Angles of Rafters, and
Purloyns in Bevel Frames.*

The Length of the Rafters is shewed before, to find it by the half breadth of the Square or Bevel-end, and the Perpendicular answerable to that Roof, (as afterwards in the Example.) And the Angle of the Foot, and outlides or backs of the Bevel-end Rafters, and the upright of the Gable end, must be to an Angle less and more than 90 degrees by the Angle at the corner of the Frame where that Rafter is to stand, being more at the sharp Angle, and less at the blunt Angle, as in Figure IV you may see; the true quantity of which Angle is thus found by the Rule.

Take the Length of the Rafter for the Bevel-end in Feet and Inches, and make it a Parallel in 15, then half the quantity of Feet and Inches Bevelling, taken from the same Scale, and carried parallelly till it stay in like parts, shall shew right against it in the Tangents the Degrees and Minutes required.

And this is the Angle that the blunt corner is to be laid in Legement more than a square, and the sharp Angle less than a Square or 90 Degrees, both out of Level, and out of square also, when you tumble or stripe in, the Tenons of the Purloins, the thing desired.

Example, Let AB represent the Bevel-end of a Frame, being out of Square from the Line AC 6 foot, as the Line CB sheweth, then if AC be 20 foot, AB will be 20 Foot 10 Inches. Then draw EL the middle Line of the Frame, and GM and HK, the Lines at three quarter of the breadth of the Frame, then take ED the half Bevel, and lay it from G to F, and from H to I, and draw the Lines AF and BI, for the outside Lines of the two Bevel-end Rafters: end the two other Lines parallel to them, according to the Breadth or Scantling of your Bevel-end Rafters, as here in the figure 8 Inches broad.

Thus

Thus the Lines AF and BI represent the two end Rafter, laid in Legement to fit in the Purloins, as for their lying out of Square from the Raifing-pieces. And to the same Angle they are to be laid out at Level, that the cutting of the Purloin ends may fit the Rafter sides, when erected in their places, according as the ends F and I of the Bevel-end Rafter are; according to the Angl.s AFG and AFM, the one being 11 degrees and 20 minutes under, and the other 11, 20 above 90 degrees.

Also, Note that if PK and OM do represent a pair of square Rafter, at any intended distance from A, then TS and RQ will give the true Length of the Purloins fit for those places, RQ being the shortest Purloin, and TS the longest Purloin.

To find by the Rule only how long the Purloin must be on the outside more or less than the distance on the Raifing-pieces, where you intend the two Square Rafter feet shall stand, do thus: set the 30 Scales to the same Angle that the Bevel-end Rafter lie out of Square, when they lie in Legement, to frame which here is to 11 degrees and 20 minutes.

Then count from the Center the quantity of Feet and Inches you intend to make the Mortise-holes from the Rafter Foot, in the Rafter, for the Tenons of your Purloins; and take from thence to the nearest distance to the other Line, and that shall shew the quantity that the one Purloin is to be longer, and the other shorter, than the distance between the Rafter-feet on the Raifing pieces. Example thus:

Set the 30 Scales to the Angle GAF, then count AS the place for the Mortise-hole from A on the Rafter, and take the nearest distance from thence to the other 30 Scale that shall give SV, the quantity how much TS is shorter than AO, and how much RQ is longer than PB.

Note, that if you count 3 quarters of 20 Foot 10 Inches, being the Length of the Bevel-end, that then you will make the Rafter too long by 4 Inches and a half, as in the Figure you may see: therefore the surest way to find the Rafter Length is to set the Scales to a Square, and then to take the Parallel Extent from the Common Perpendicular, to the $\frac{1}{2}$ breadth between the place for the Rafter-feet on the Raifing-piece: So that the Length of the Rafter for the Bevel-end at true pitch, is AF 15 Foot 3 Inches, and not AW 15-7- $\frac{1}{2}$, which is

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just 3 quarters of AB the Bevel-end over which the two Rafter's are to stand. For then the top of the Bevel-end Rafter's would be too high for the top of the Square Rafter's being cut just 15 Foot, three quarters of 20 Foot the breadth of the Frame.

use XX.

The Use of the Scales to lay down or measure out on Paper, or Board, the Members and Parts of the fine Columns, and their Ornaments, with their names and measures, digested into a Table, for the more ease and use of Workmen.

For the drawing of the fine Columns and their Ornaments is largely before treated of in the former part, by models, minutes and quarters, and considering the harmony between it and our Scales to 30, that are parted into 12 parts, so that when every Figure or Foot, on the Scales to 39 represent a model, then every Inch is 5 minutes; and for small Paper-draughts, that way of counting is near enough; but when you use it for a bigger draught, that the whole Scale of 30 may represent 3 models only: then every Figure will represent 6 minutes, and the 12 Inches between are half minutes: but in very great Work, as in Temples, or Castles, then the whole Foot or Scale to 30 may represent half of one Model only, and then every Figure or Foot is a Minute, and every Inch or small division is the 12th part of a Minute; for I count it to be a large Column, whose Diameter at the Base (which is a Model) is above 3 Foot, and by this manner of computation, which is natural to most Scales, the Scales to 30 may be rendred convenient for small, or moderate, or large uses, as in the following Examples may somewhat appear.

In reading of which you must have recourse to the former Figures, whose Members are marked with 1 2 3 4 5 6 7 8 9 10, and which Figures direct you to the names in every of the Columns which I found to be wanting in the former part, so that the method here used is thus:

1. The first Column in the Table is 1 2 3 4 5 6 7 8 9 10 11 12, &c. answerable to the Figures on the 6th Figure, in our present Example, which will streightway guide you to the meaning of the names or terms in the Table by comparing it and the figure together, whereby you may readily find every part or member, and its proper name.
2. The

2. The second Column is the names of the Part or Member in the gross and particular also, as the Pedistal, the Base, the Shaft, the Capital, the Architrave, Frieze, and the Cornice, are the names in gross; the other are the names of the members in particular.

3. The third Column in the Table is the several measures of the particular members, in Models, Minutes, and Quarters, as in the Figures, though more easily to be seen than in the Figures, because of the straightness of the room there.

4. The fourth Column in the Table is the measure of every particular part and member from the Pedistal, Base or bottom, to the top of the Cornice, being useful in small draughts where the whole Pillar is express.

5. The fifth Column in the Table is the several measures of every particular member of each gross part, being useful when you draw large draughts of any Work, or part thereof.

6. The sixth Column in the Table is the measure of the Projecture of every particular part from the middle Line of the Column (or from the smallest or most inward part of the Pillar, the rest being subtracted) but I judge the middle Line to be the best Epocha to begin the account of projecture for the convenience of the Compasses: and this Table of Projectures as all the rest, is to Models, Minutes, and Quarters; as by trial you may see at one view what each gross part and every particular part is.

The Names and Number of the Members of the Tuscan Column in Height and Projecture.									
A Table for the Tuscan Order.					Each part from the Base		Each gross	The proj.	
					part alone		or middle		
Num.	Names of the parts and members.				mod.	min.	q.	M.	m. q.
1	Pedistal.	The lower Face, or Plint, of the Pedistal			0	30	0	0	42
2		The Pedistal Body, or Stilobatum			1	0	1	30	0
3		Abacus, the Casement, or hollow			0	5	2	1	41
4		Tinea, the List, or Square, or Rabbit			0	1	2	1	46
5		The Architrave or Faceo			0	12	0	1	47
6		The upper List of the Pedistal			0	3	2	1	46
7	Base.	The Plint, of the Base of the Column			0	18	0	2	42
8		The Thorus, or Rondel, or Brest			0	12	0	2	42
9		The List, or Fillet, or Spira			0	03	0	2	36
10	Shaft.	at the Base			6	22	0	8	30
		at the Capit.						6	22
11	Capital.	The List			0	1	2	8	24
12		The Rondel or Astragal			0	3	2	8	26
13		The Neck or Freize			0	8	2	9	22
14		The List			0	1	2	9	24
15		The Rondel, or Bead-molding			0	2	2	9	26
16		The Echinus, or Half-round			0	7	2	9	30
17		The Plint of the Capital			0	10	0	9	31
18	Architrave, Cornise, Frize or Corona.	The first Faceo			0	10	0	9	22
19		The second Faceo			0	15	2	9	24
20		The List or Supercilium			0	1	2	9	26
21		The Plint			0	3	2	9	27
22		The Zoporus, Epistylum or Frize			0	40	0	10	22
23		The List or Supercilium			0	2	0	10	23
24		The Scimatum or little OG			0	5	0	10	26
25		The Supercilium or List			0	1	10	4	30
26		The Scima or greater OG			0	8	2	10	35
27		The List			0	1	2	10	49
28		The Corona or Crown			0	9	3	11	50
29		The List			0	1	2	11	52
30		The upper Scima or OG			0	8	0	11	56
31		The Supercilium, List, Tinea, or Eyebrow			0	1	0	11	49
32		The upper List or Plint of the Cornish for the Tuscan Column or Order			0	3	0	11	52

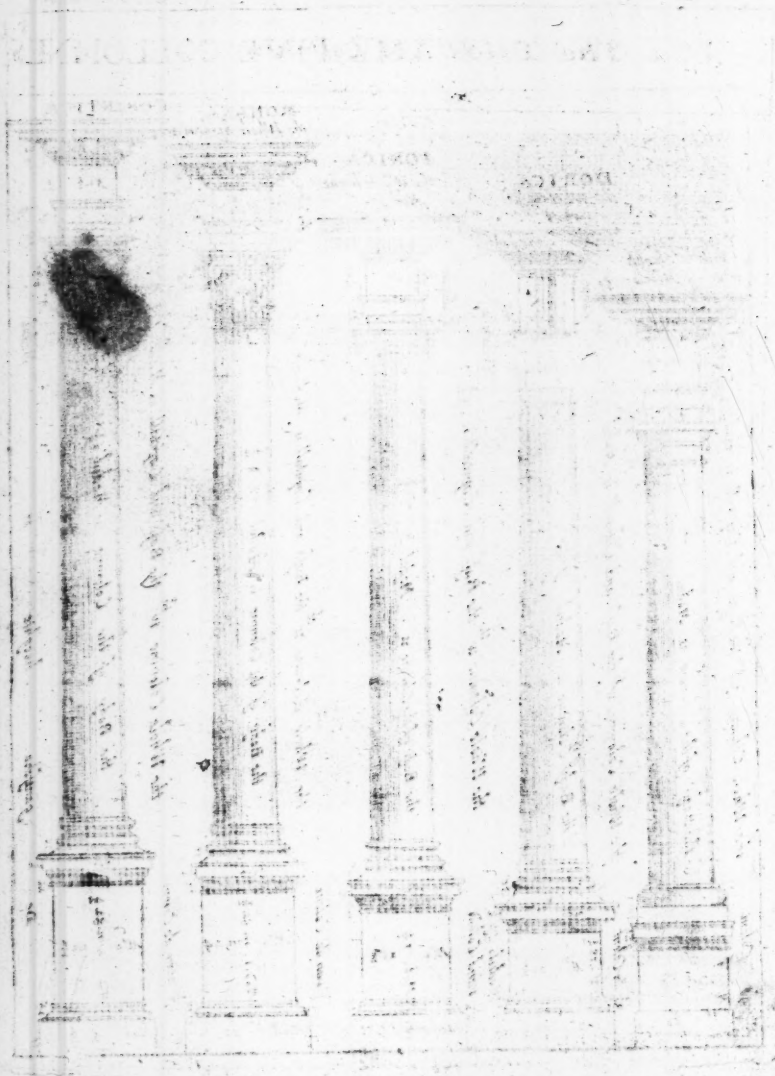
Thus I have given you an Example of the *Tuscan* Order of the measure of every Part and Member: the like may you make, from the Figures in the Book, of all the other Orders, for your particular use and occasion.

F I N I S.

The said Rule with all other Mathematical Instruments are made and sold by *John Browne*, living in the *Minories* at the Sign of the Sun-Dial, and by *Walter Henshaw* in *East-Smithfield* near the *Hermitage*.

There is also to be sold by *William Fisher* at the *Postern* at *Tower-Hill*, a very useful Book, Entitled, *The Description and Use of the Carpenters Rule, together with the Use of the Line of Numbers*, commonly called *Mr. Gunter's Line*. Also the Book of *The Five Columns of Architecture*, by *Hanc Bloome*.

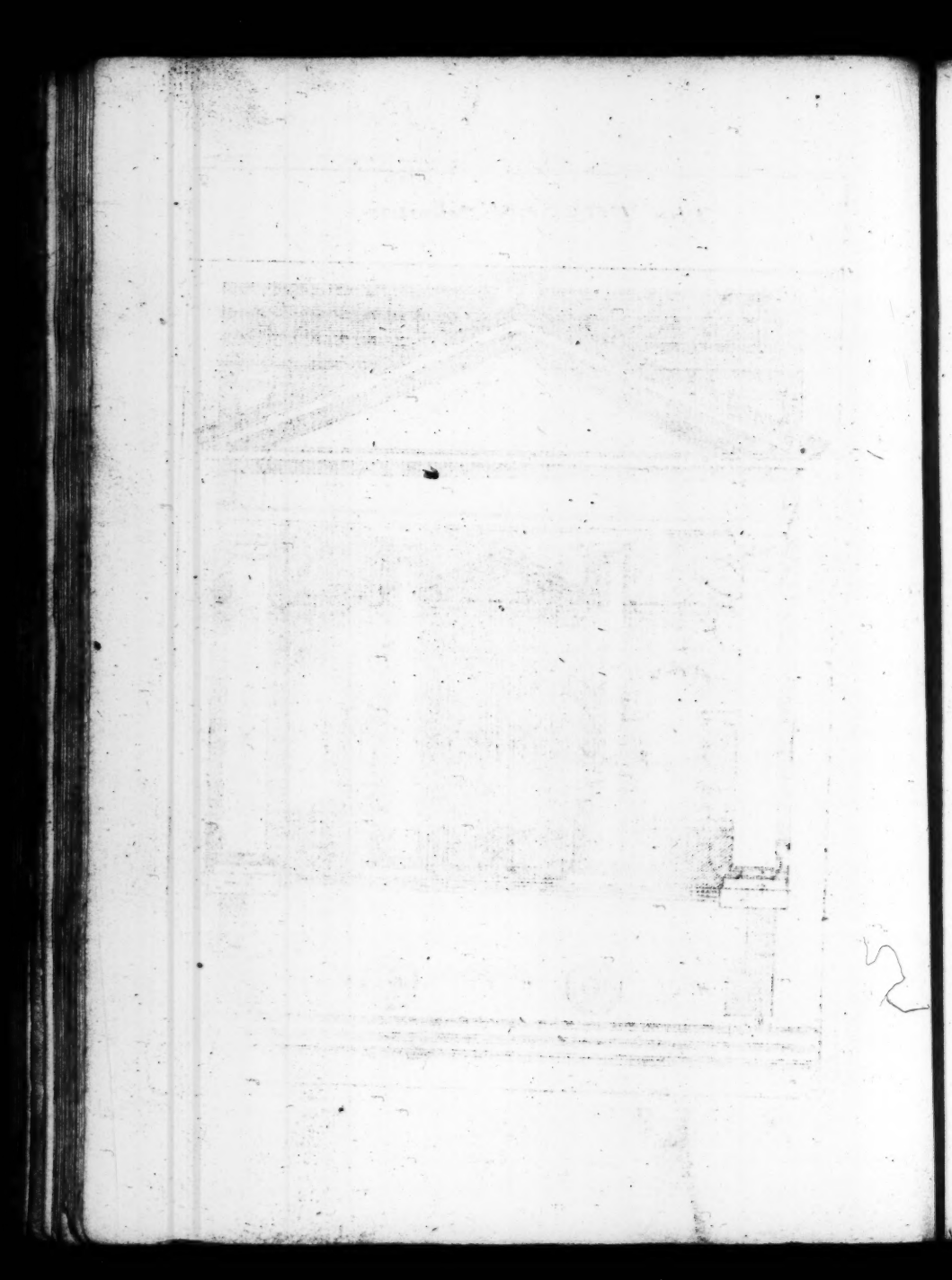
F. N. I. S.



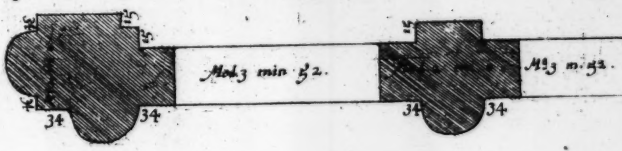
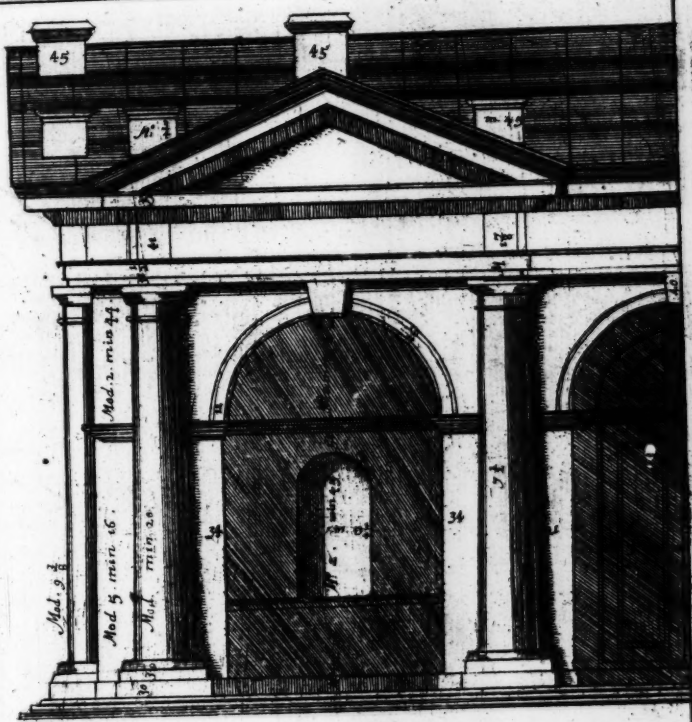
The TUSCAN Colonne

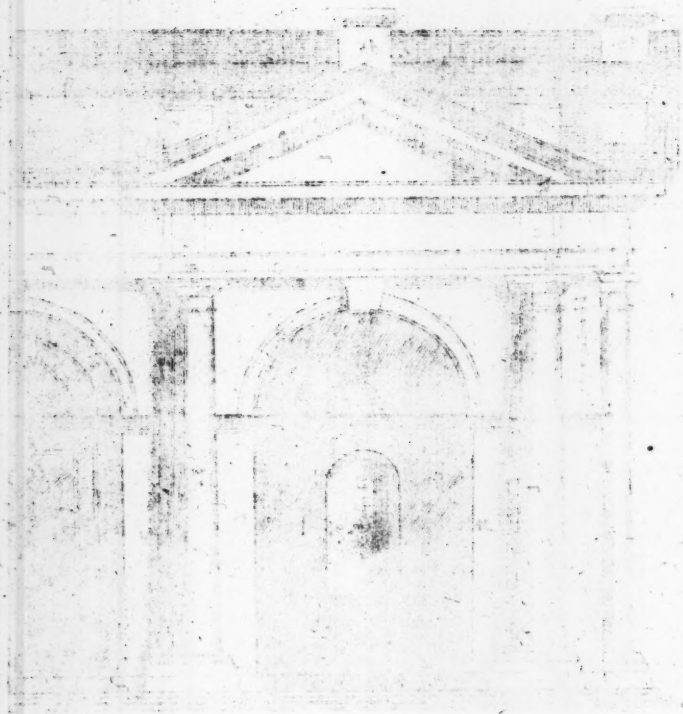
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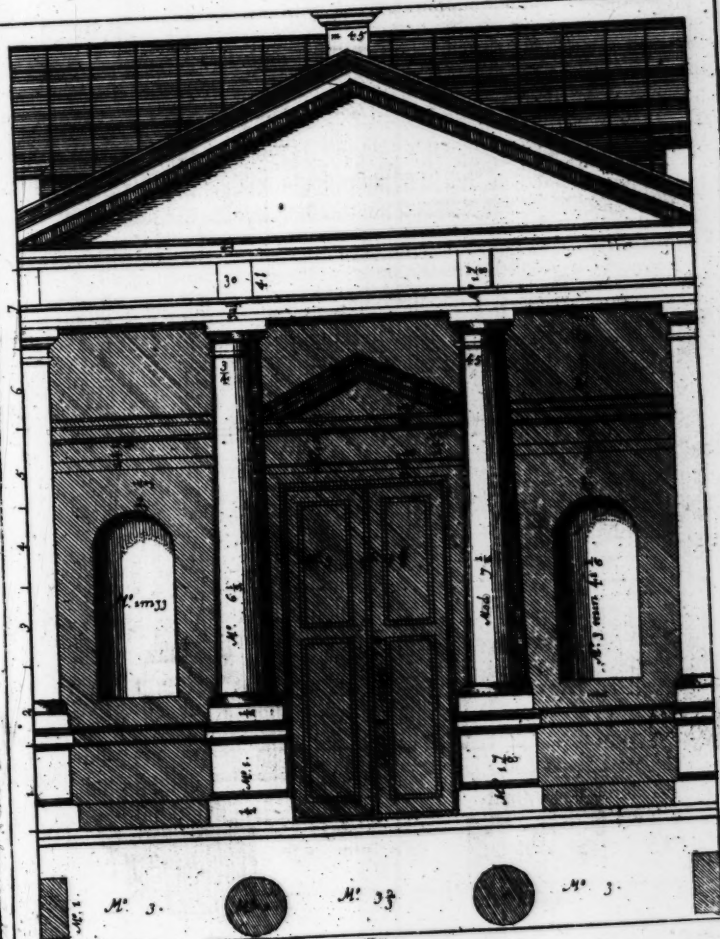


The TUSCAN Arch

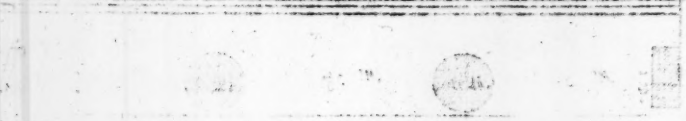
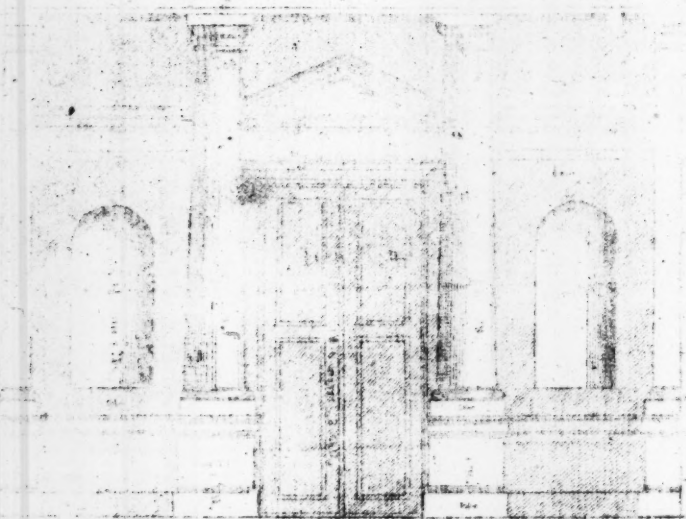
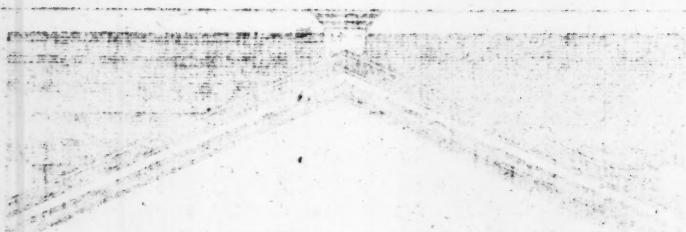




The TUSCAN Colomne with y^e Pedestall



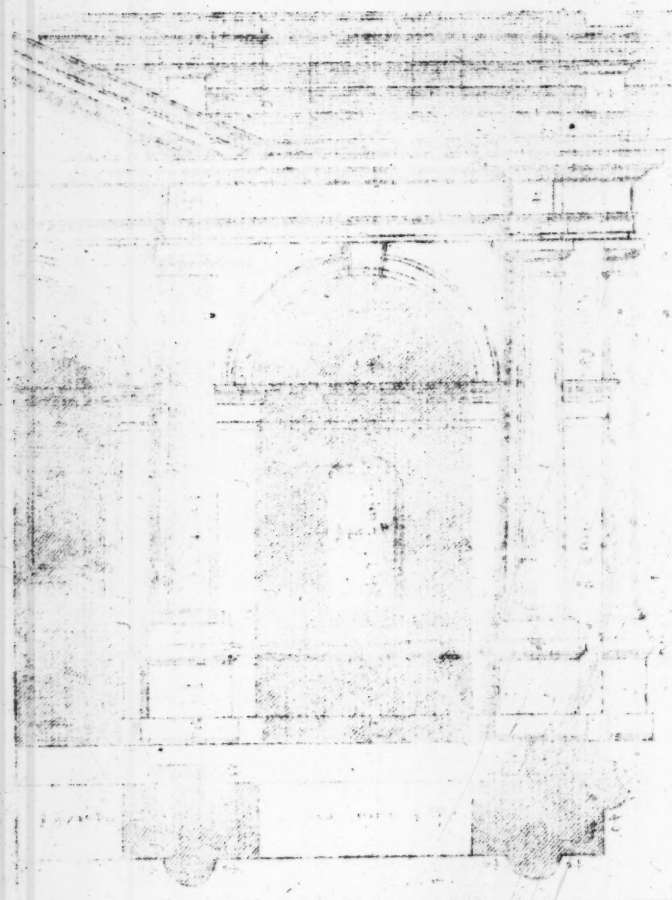
THE NEW YORK CHAMBER OF COMMERCE



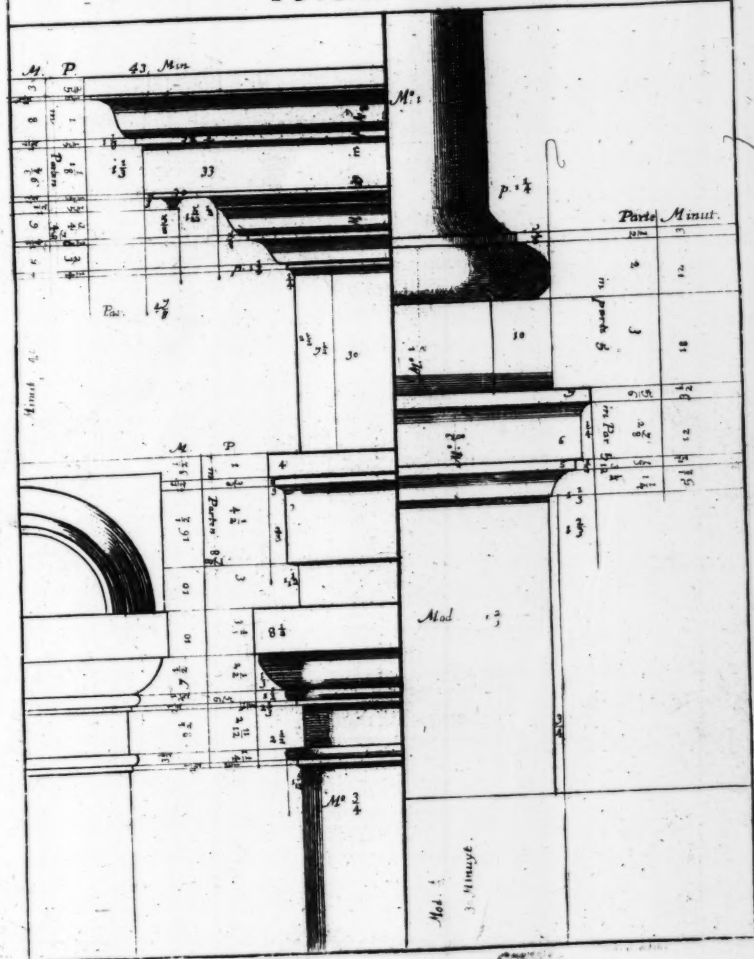
The TUSCAN Arch wth Pedestall



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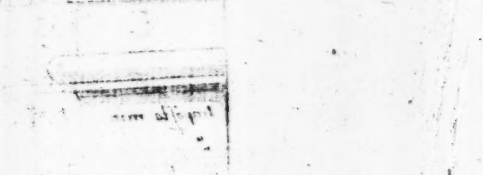
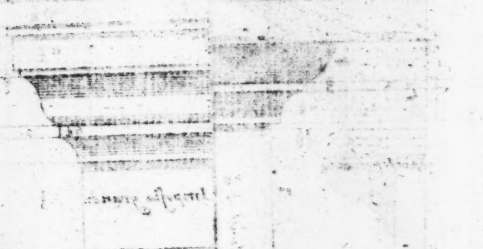
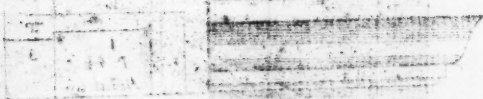
The Pedestall Base and Ornament of the TUSCAN



7

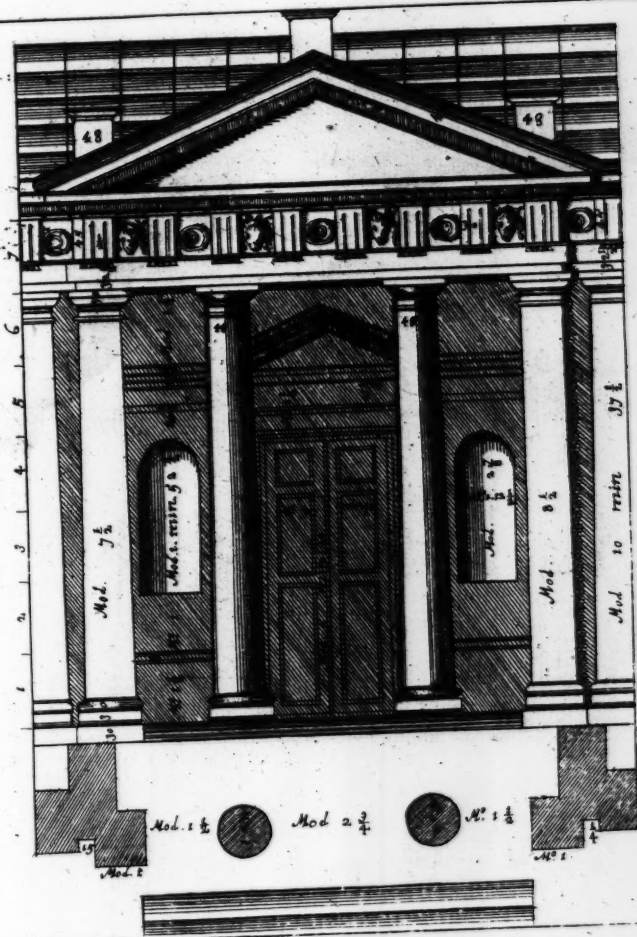
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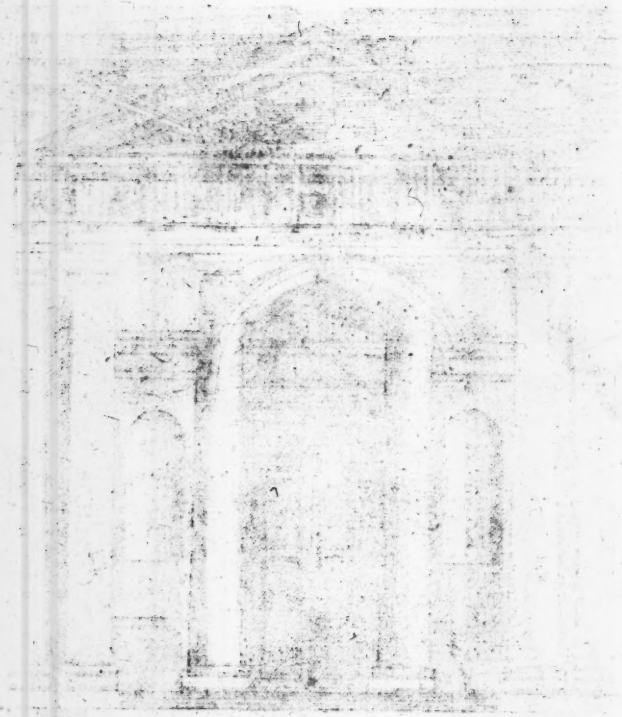
INDEPENDENT GOVERNMENT OF TUNISIA



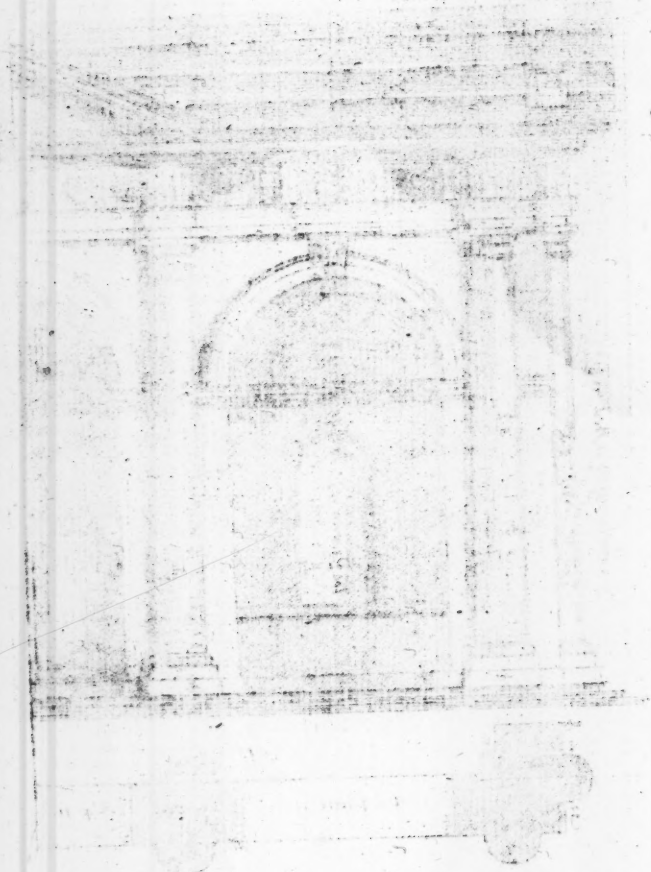
The DORICK Colomne

8





THE TOWER

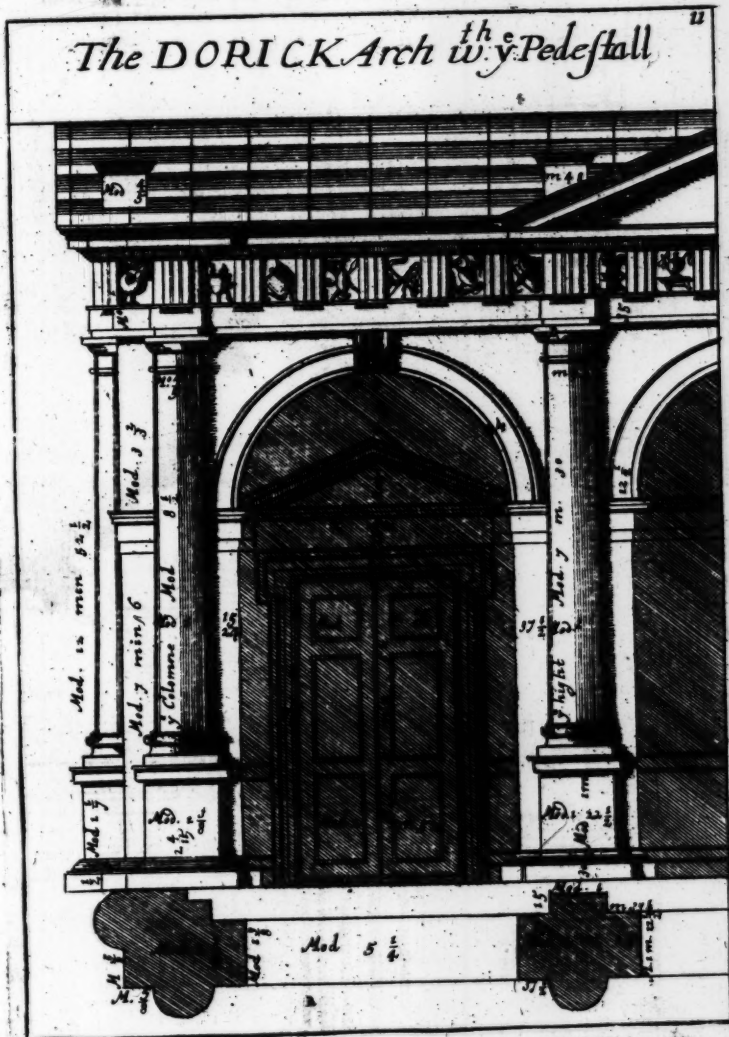


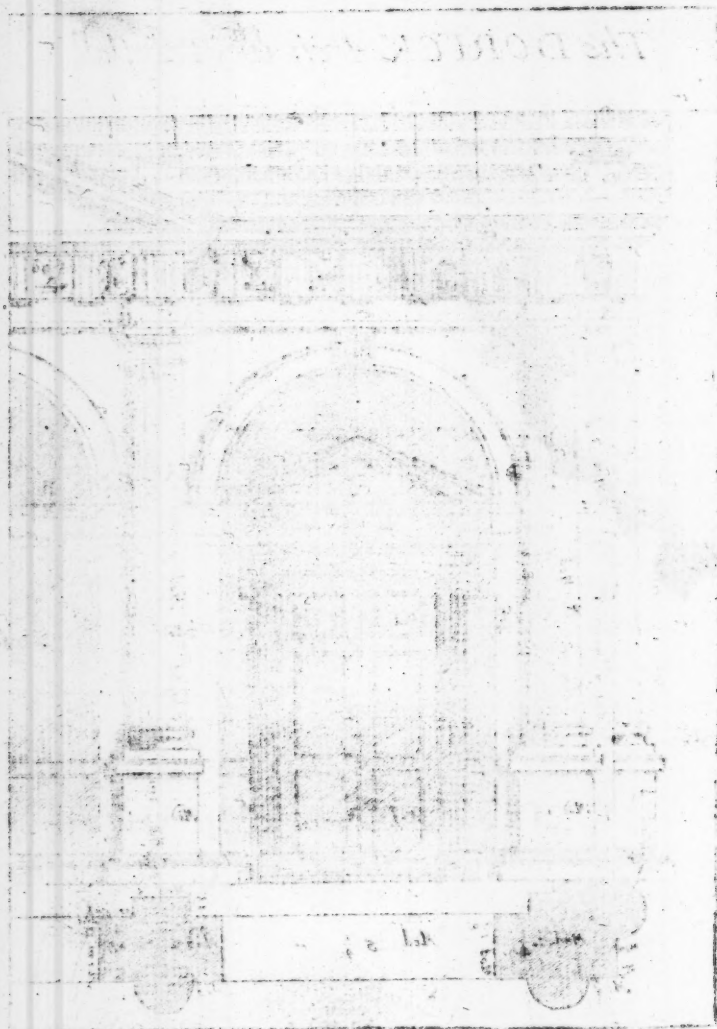
1870

1870

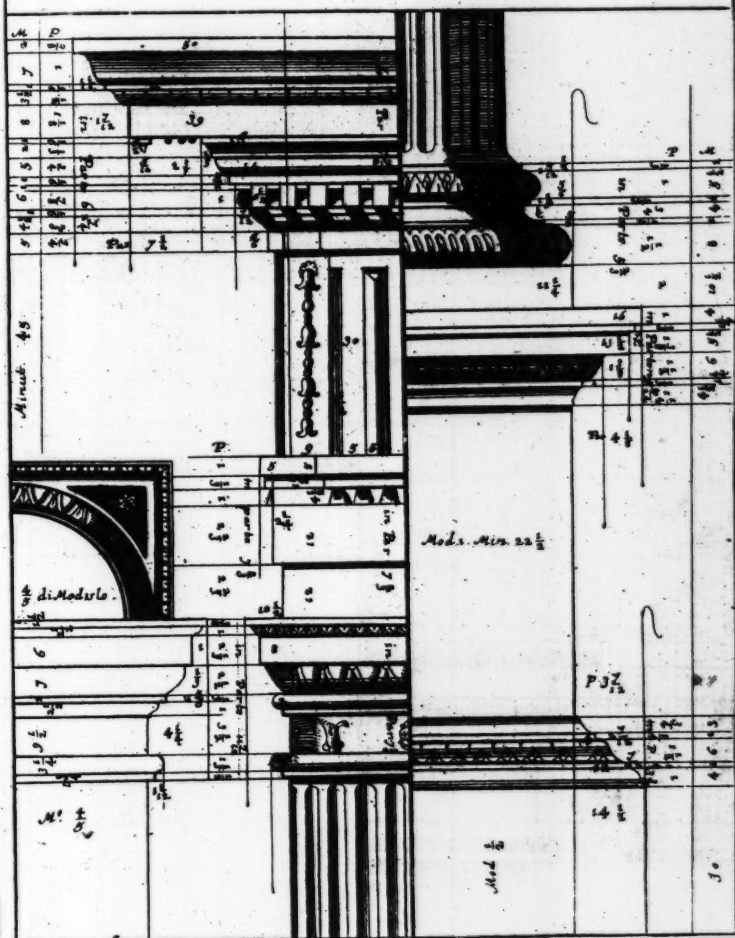
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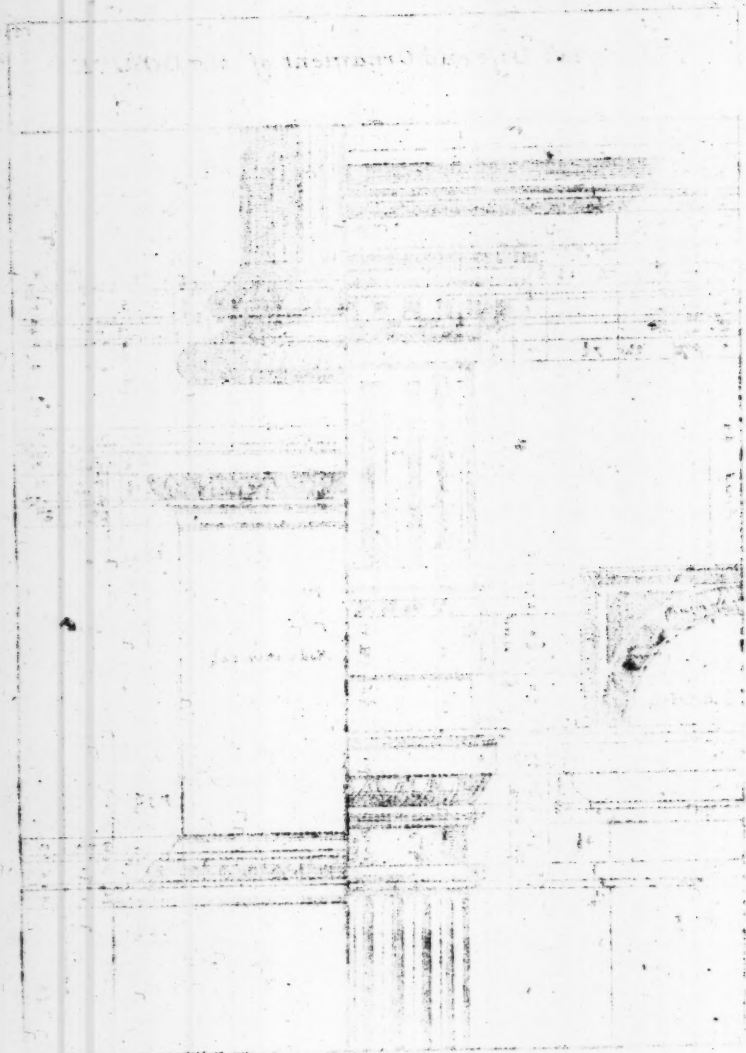
The DORIC Arch wth Pedestall

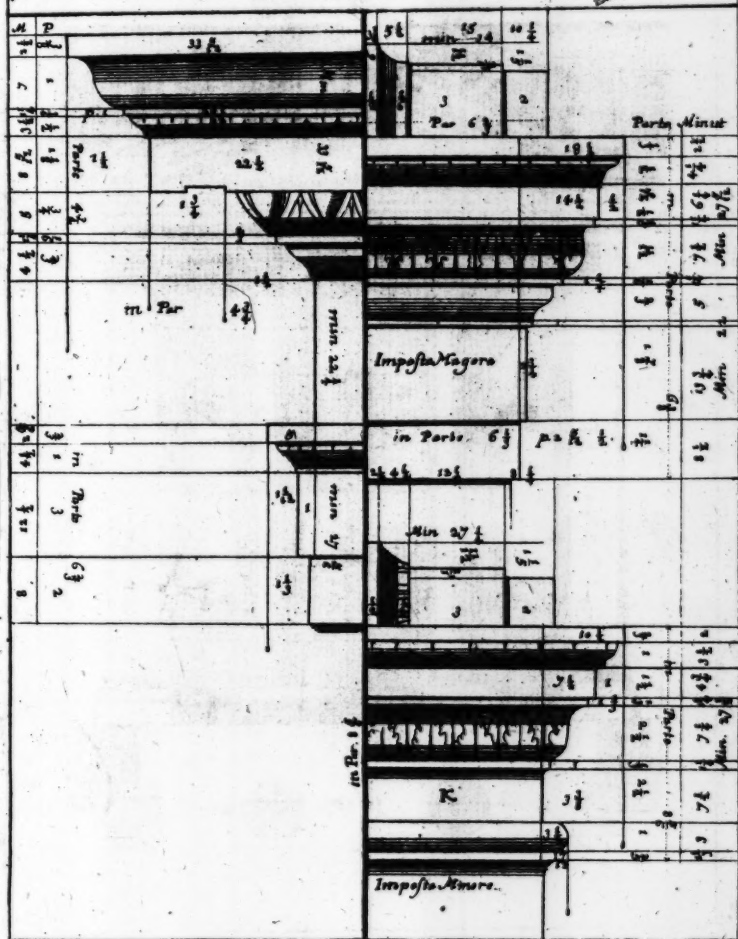




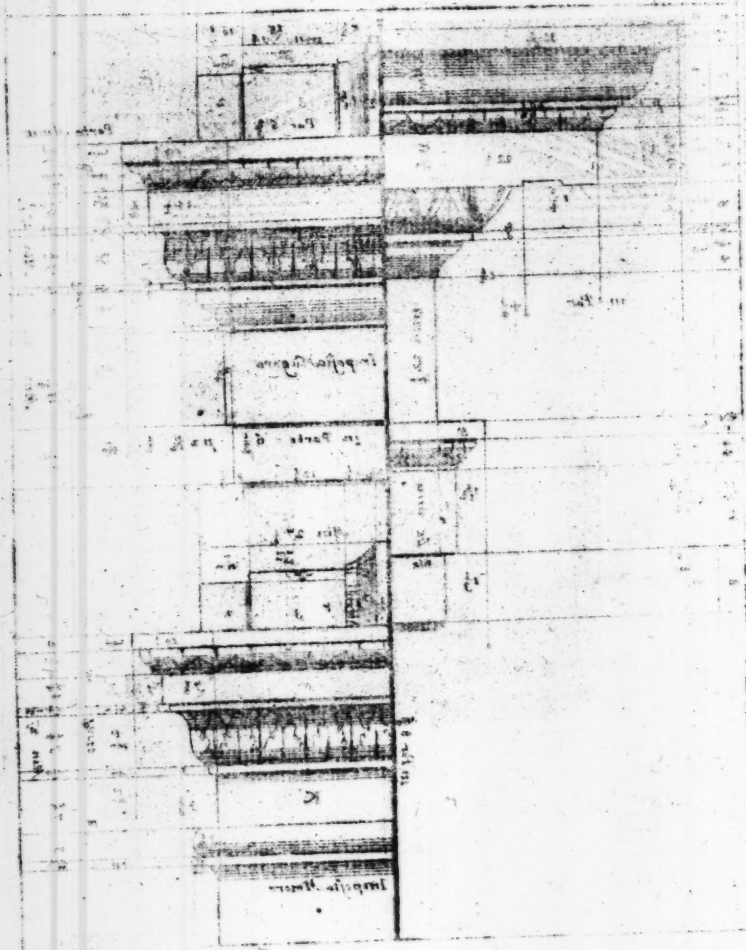
Pedestal, Base and Ornament of the DORICK

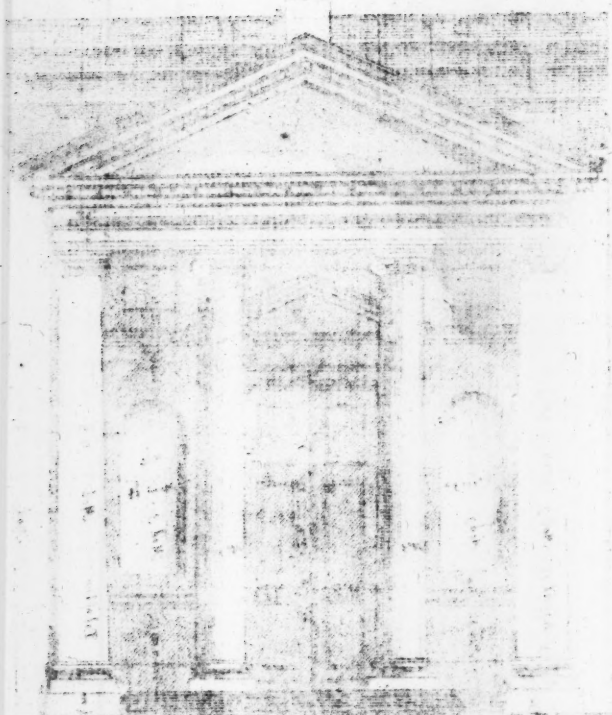


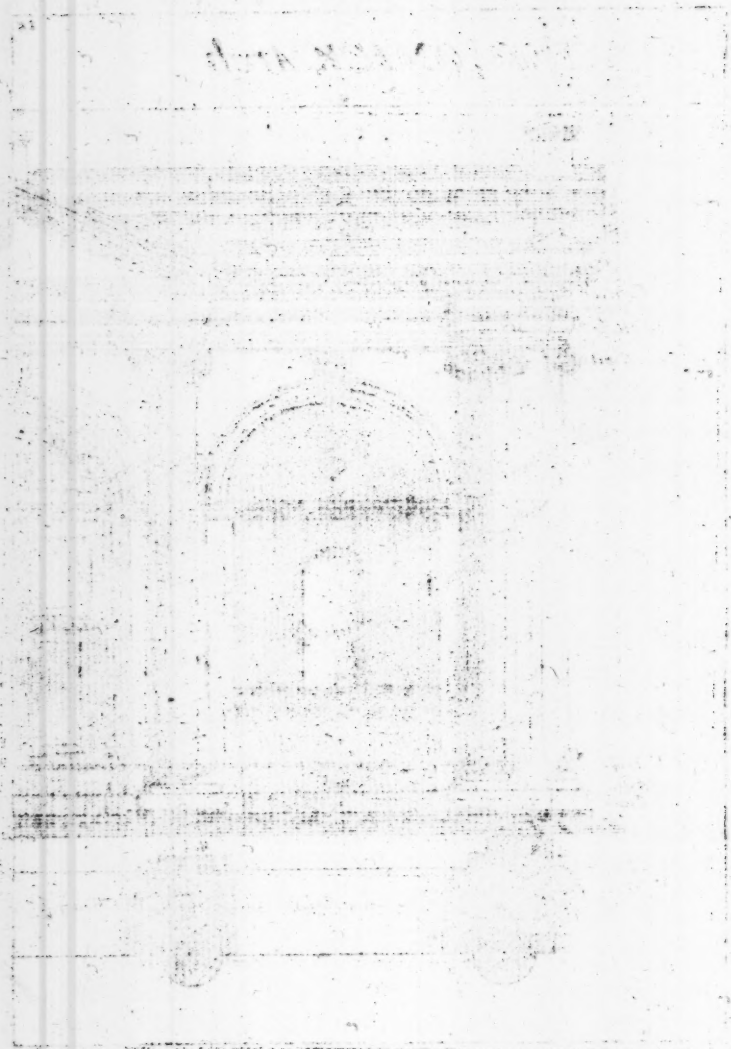




Improvement of the River of the City of London







March 2nd 1867

Received of the
Hon. Secy of the Interior
for the same

the sum of

Five hundred and
no/100

Dollars

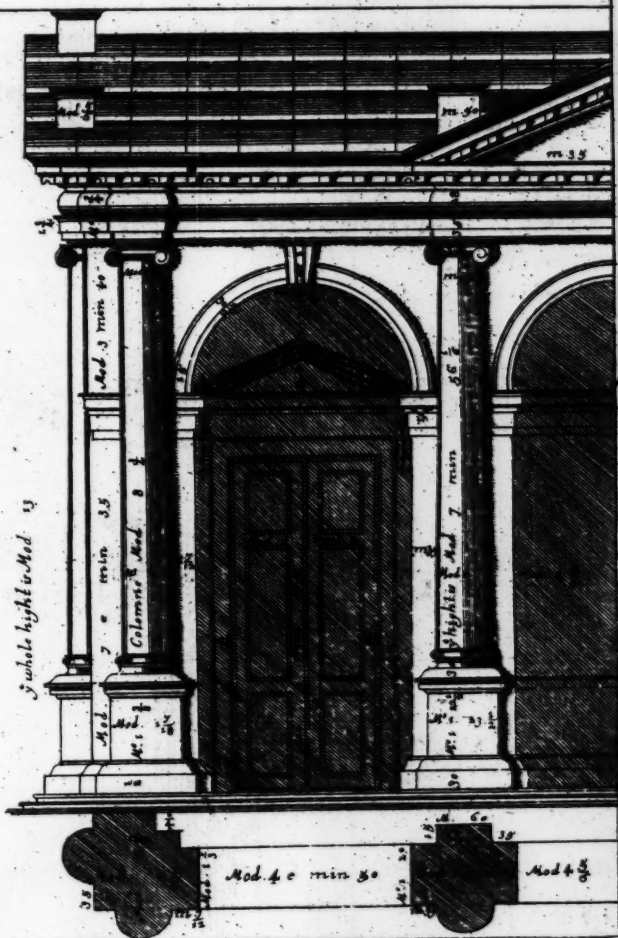
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The IONICK Arch wth Pedestall

17



1944-1945

100

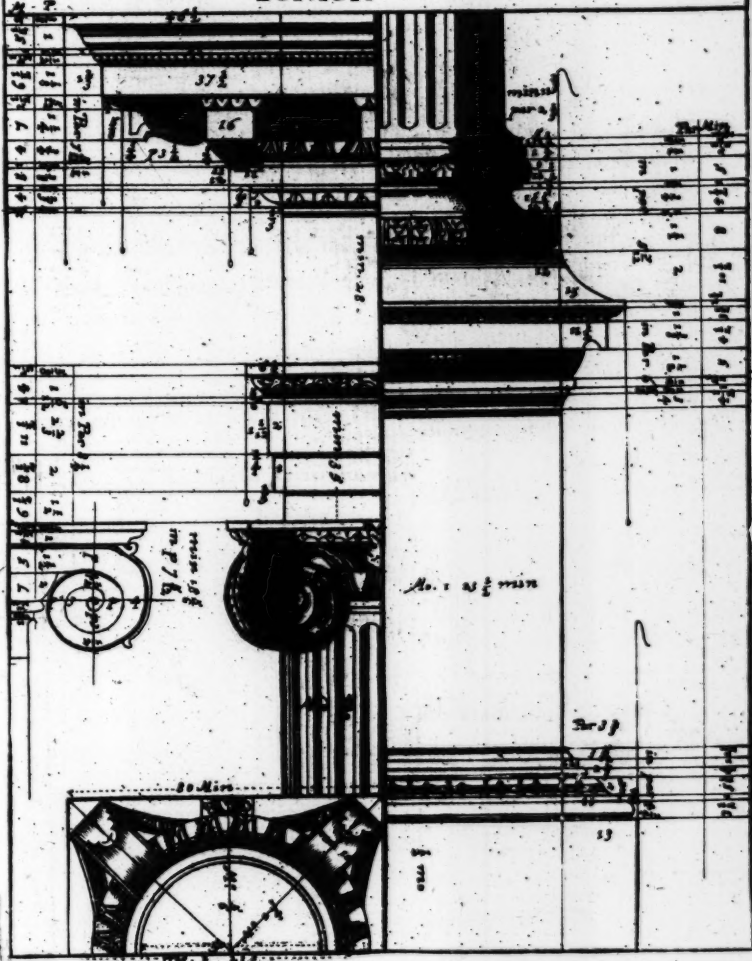
1990

1875

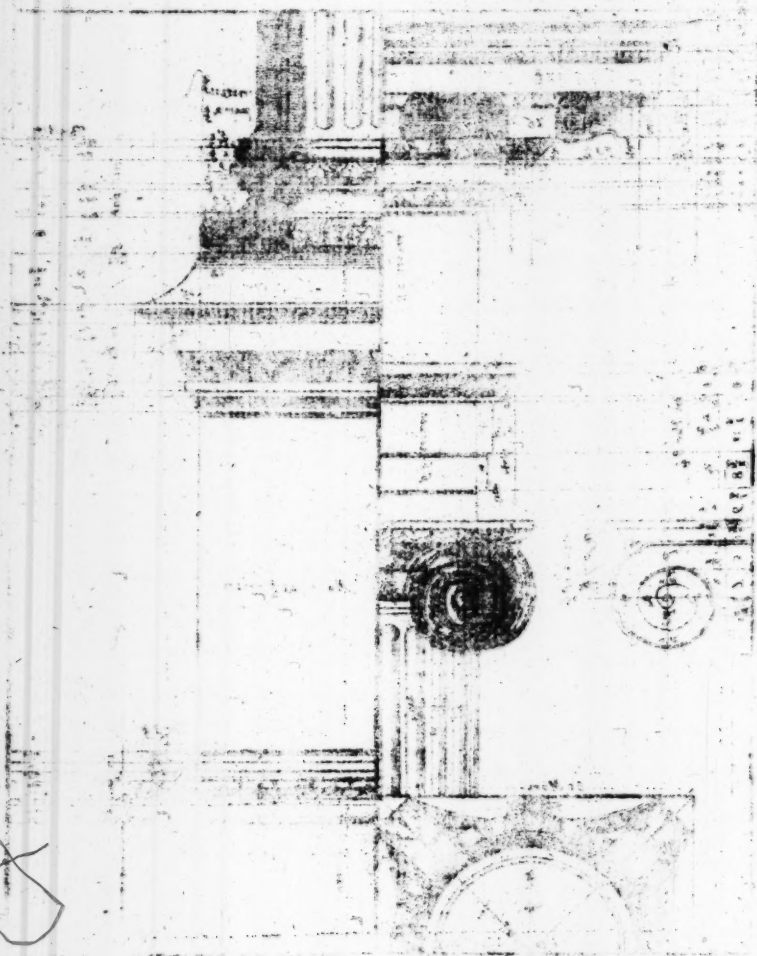
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1990

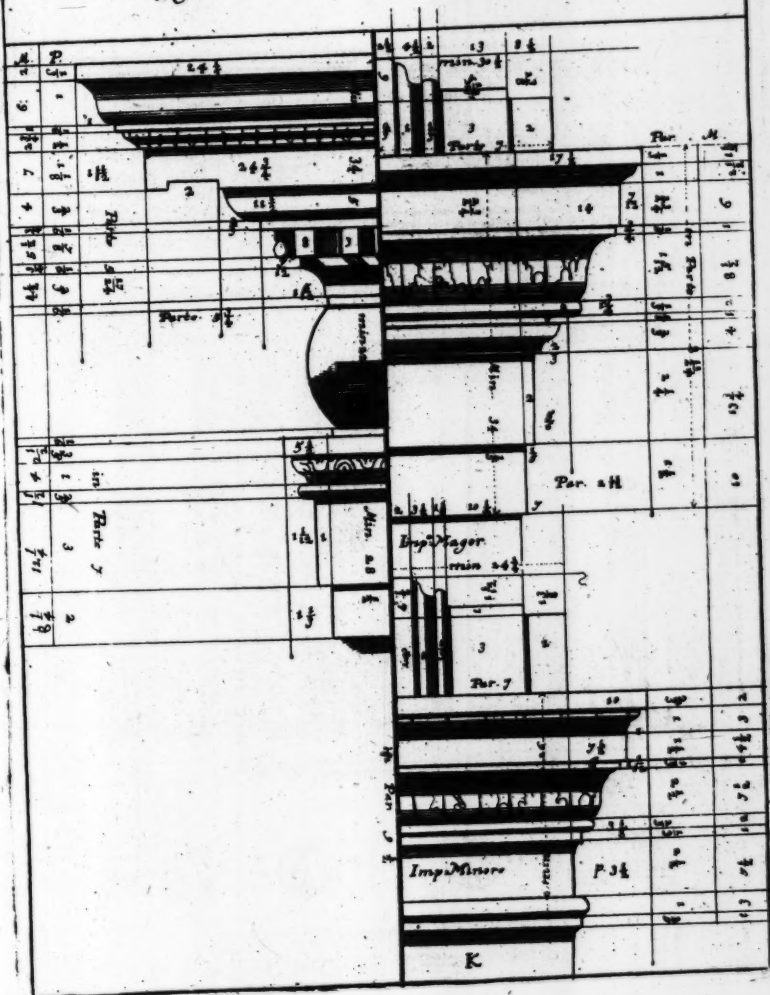
Pedestall Base and Ornament of the **IONICK**

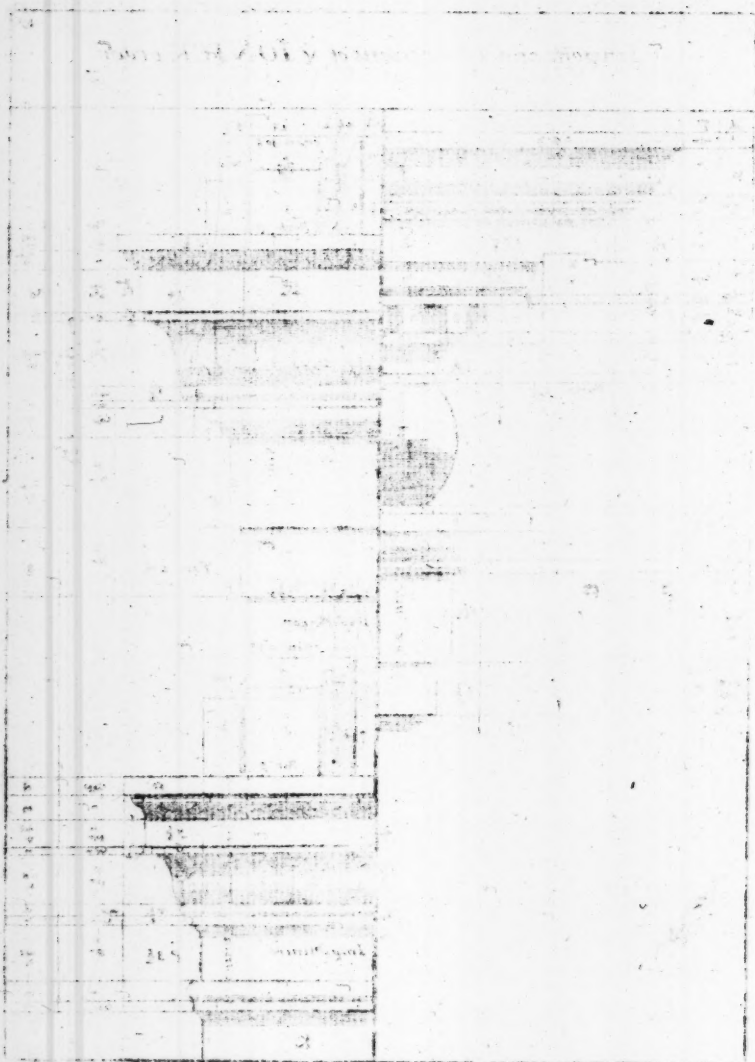


Refectory of the

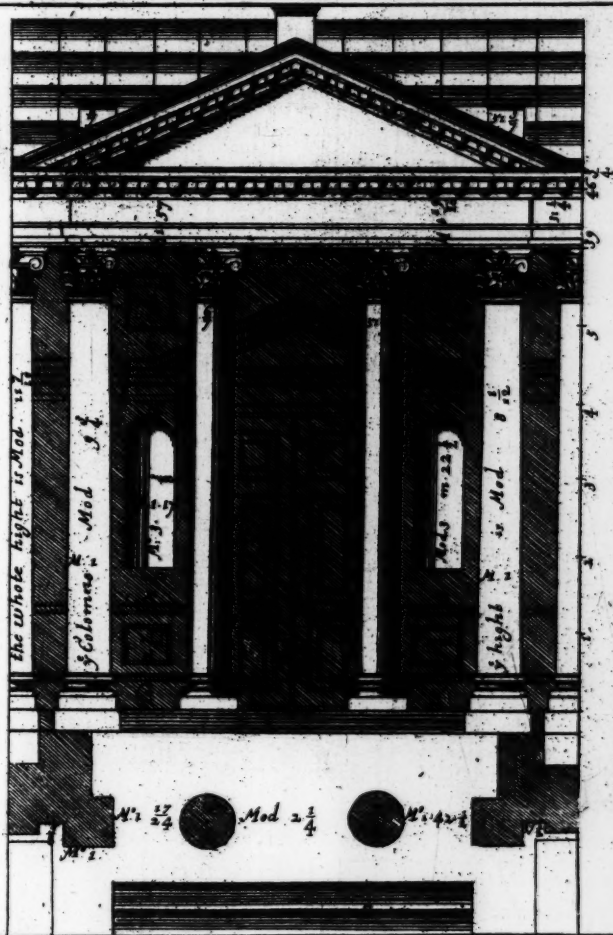


Imposts and Ornament of γ IONICK order.



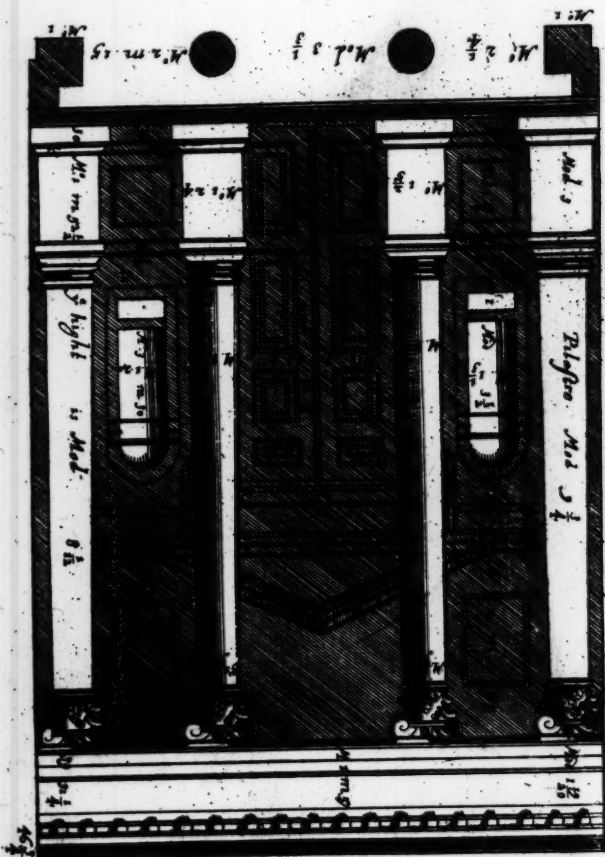


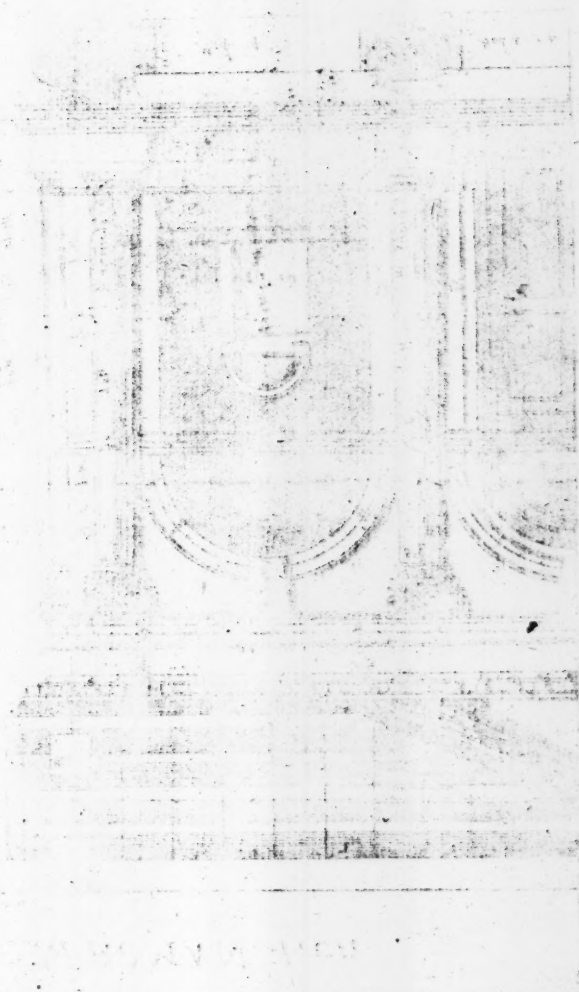
The ROMAN Colonnade

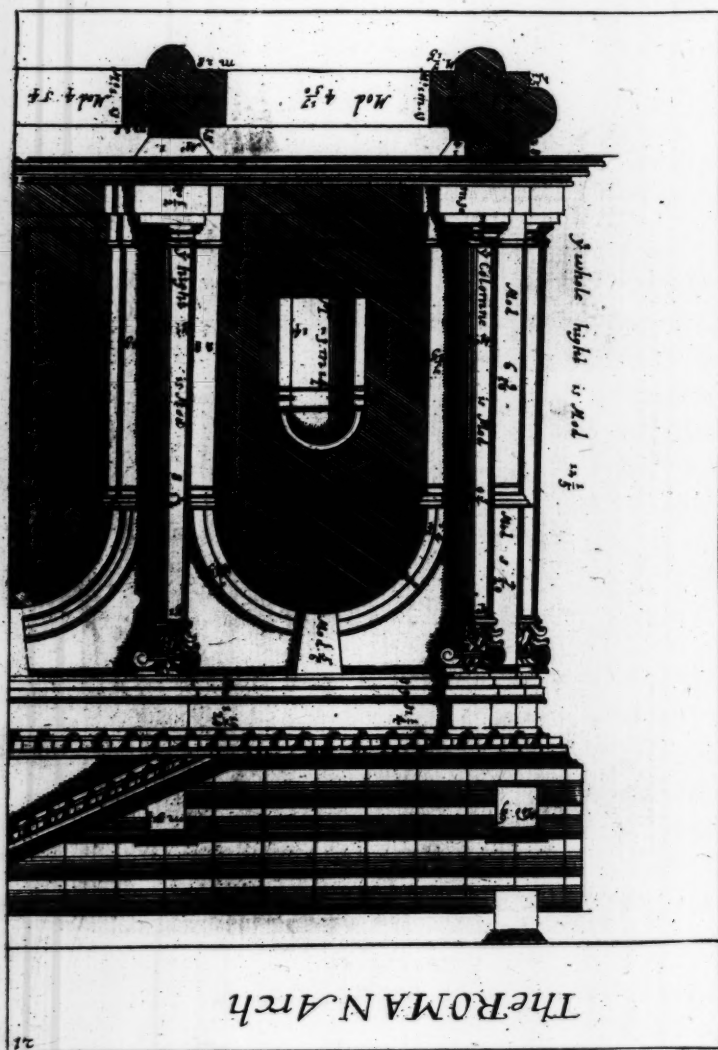


Y: ROMAN, Colonne wth Pedestal

22





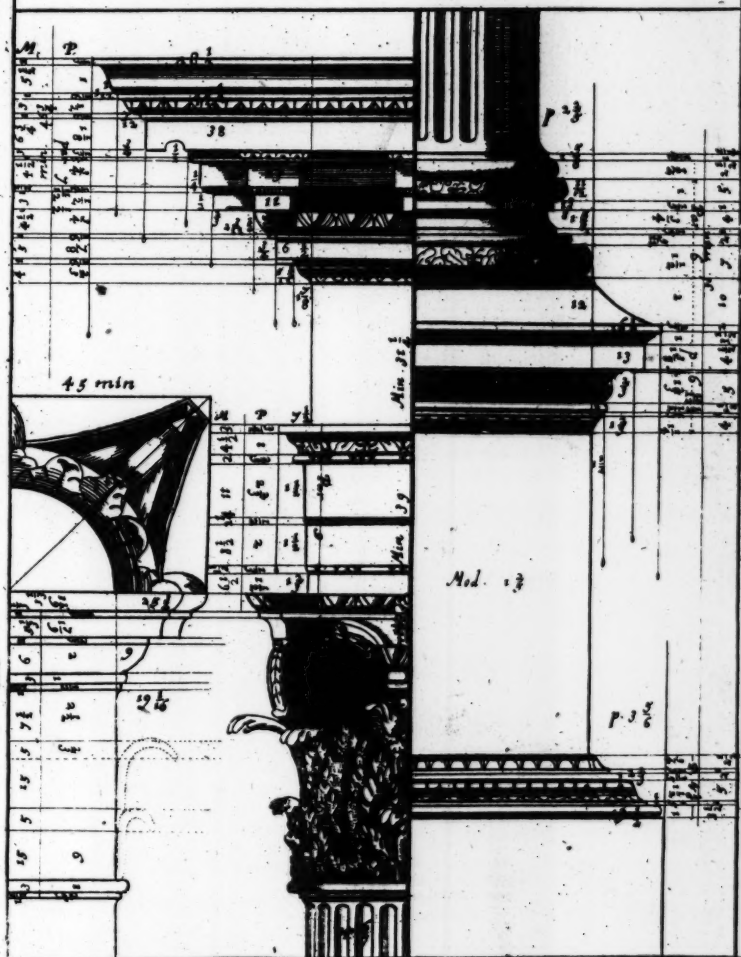


The ROMAN Arch

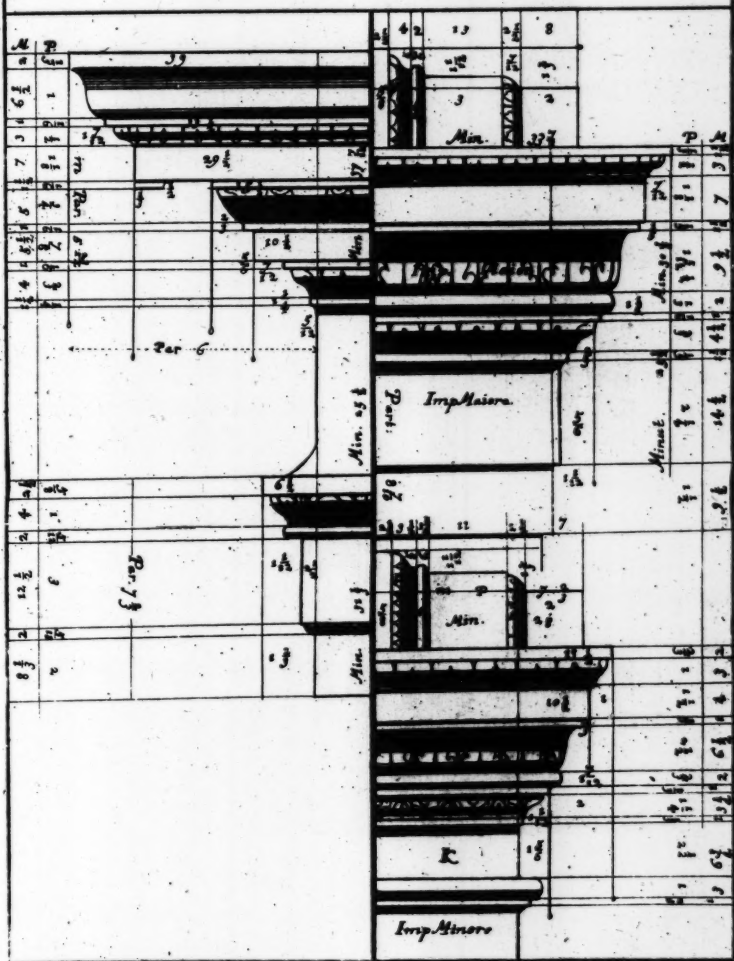


Pedestall Base and Ornament of y^e ROMAN

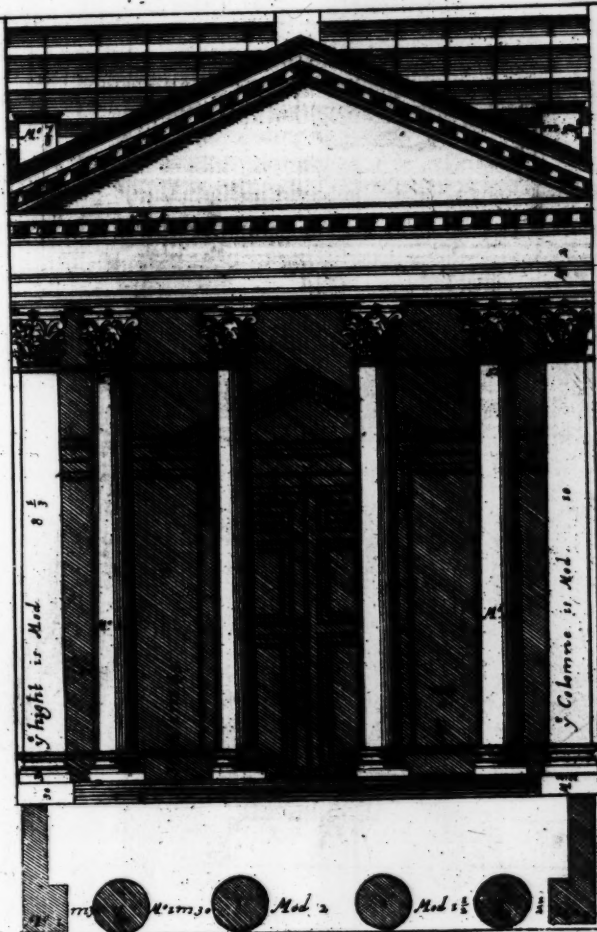
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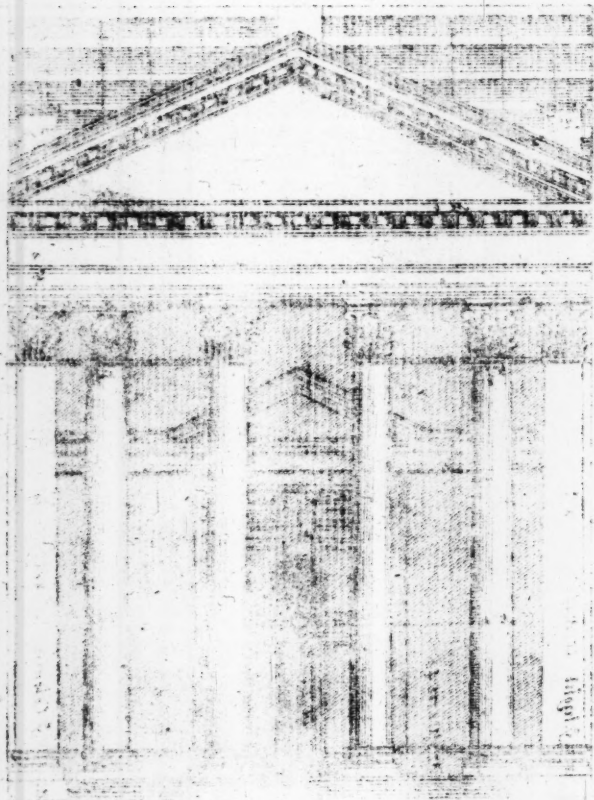
Imposts and Ornament of y^e
ROMAN

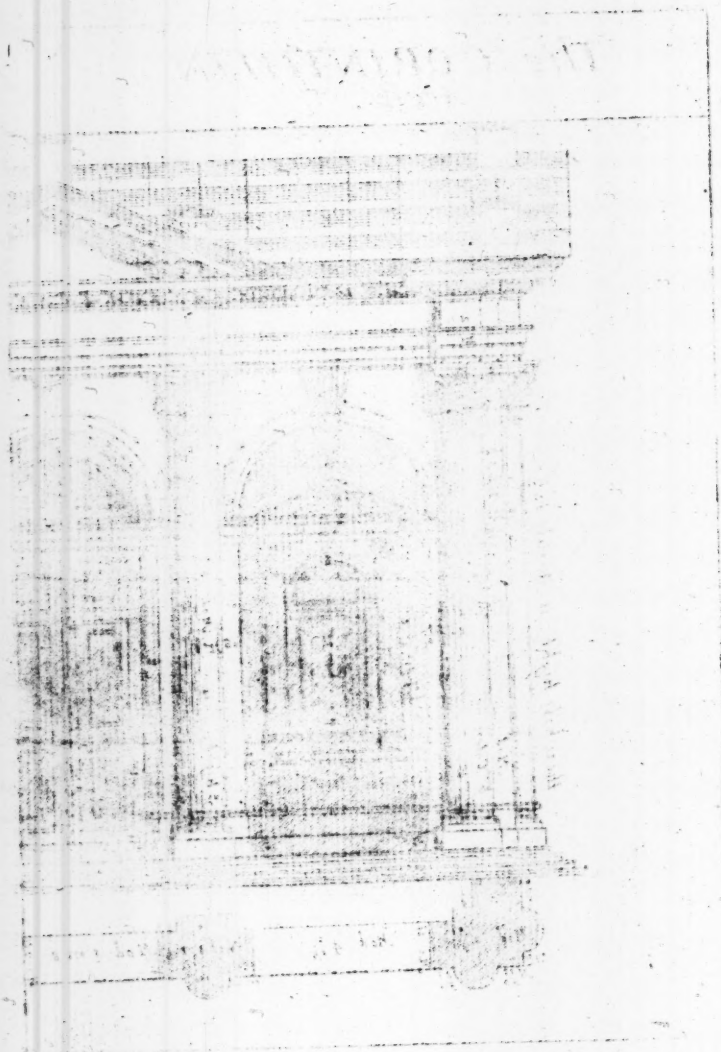


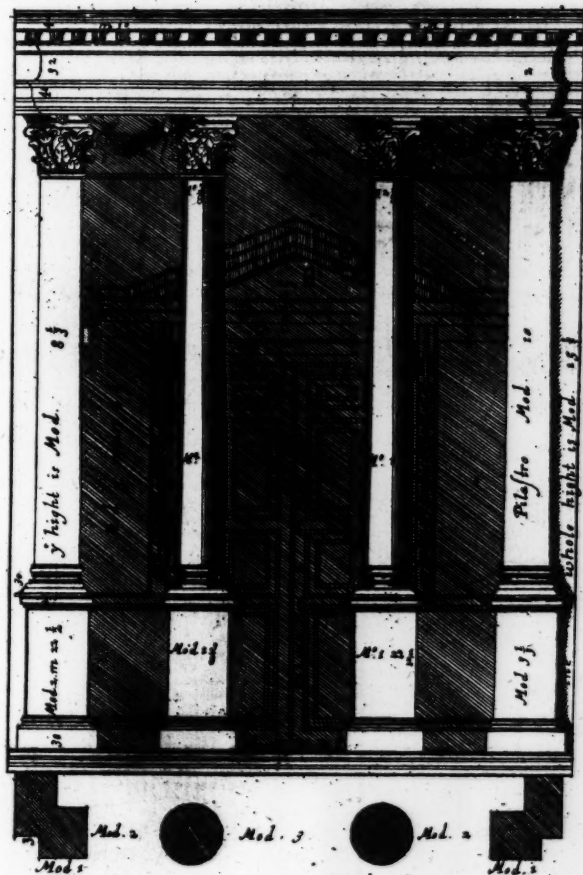
The CORINTHIAN Colomne

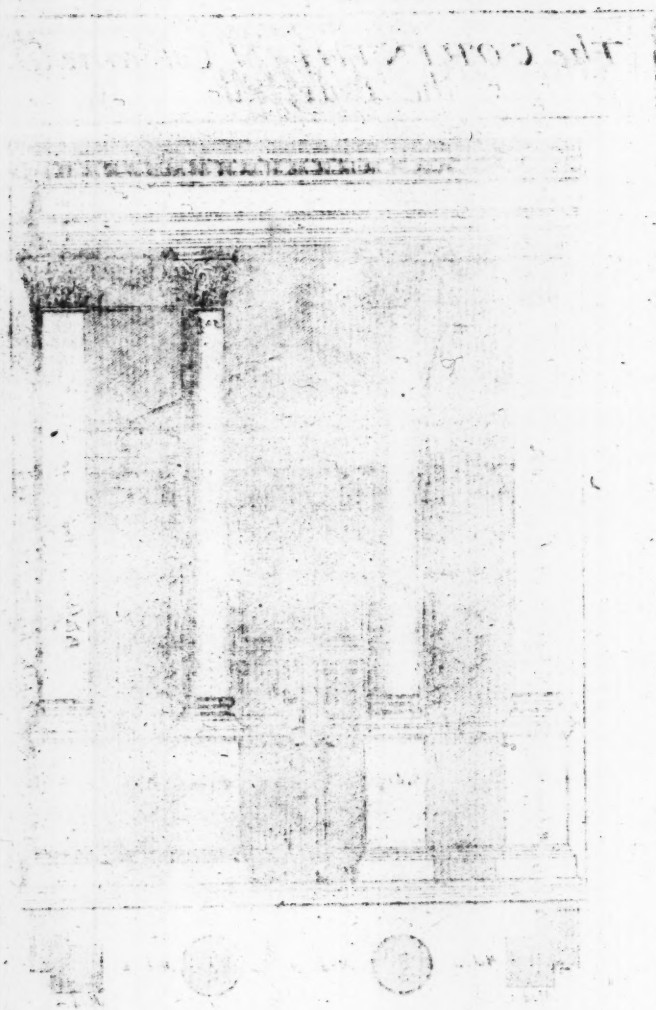


THE CORINTHIAN COLUMN

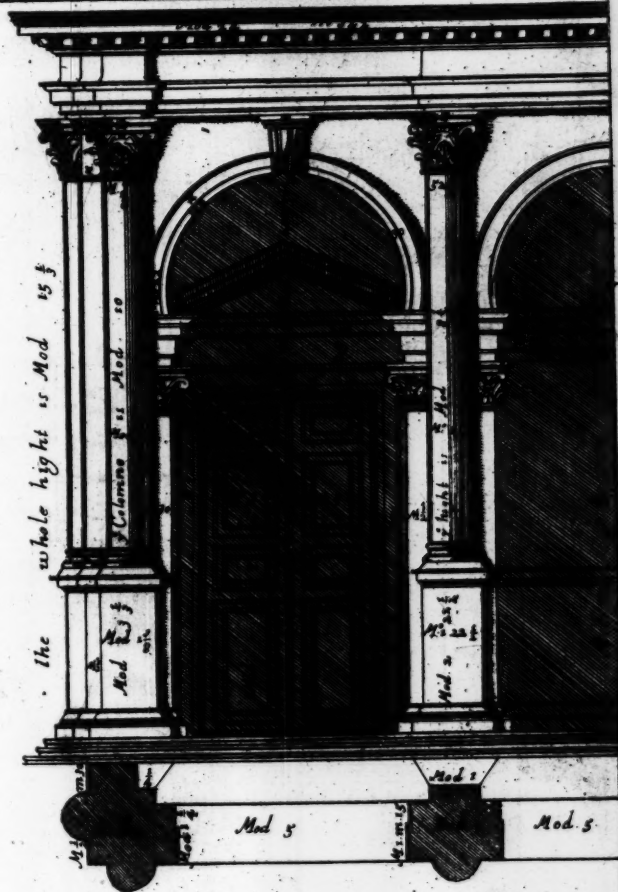




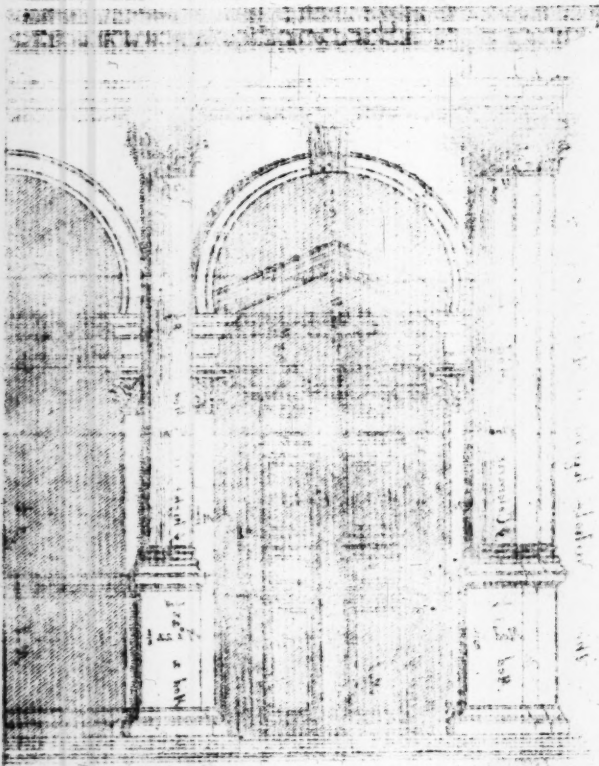




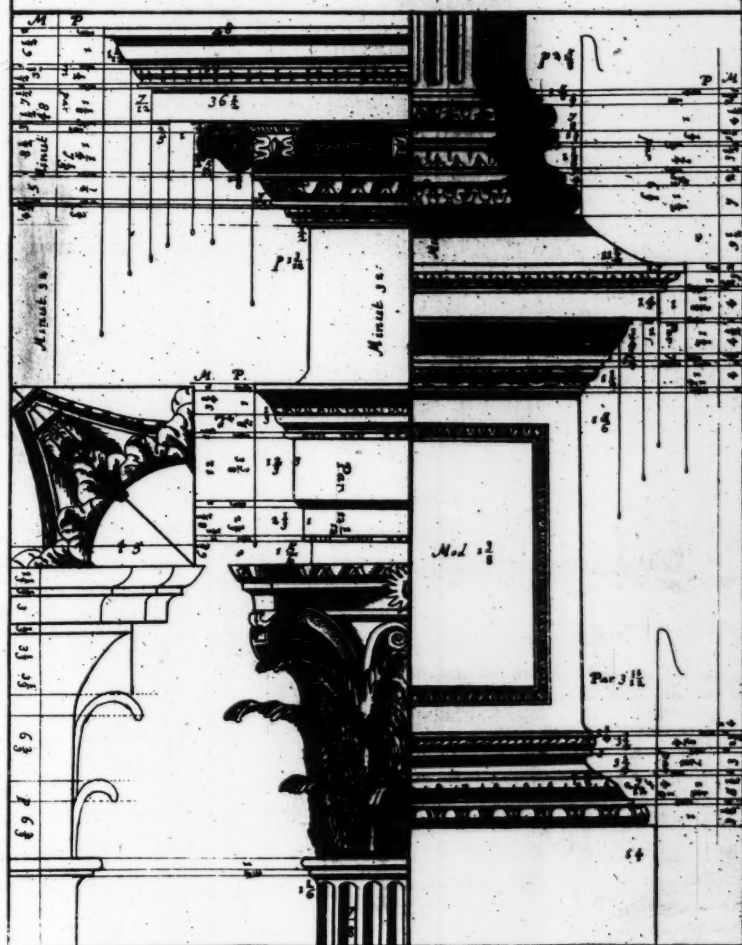
The CORINTHIAN Arch wth y^e Pedestall 29

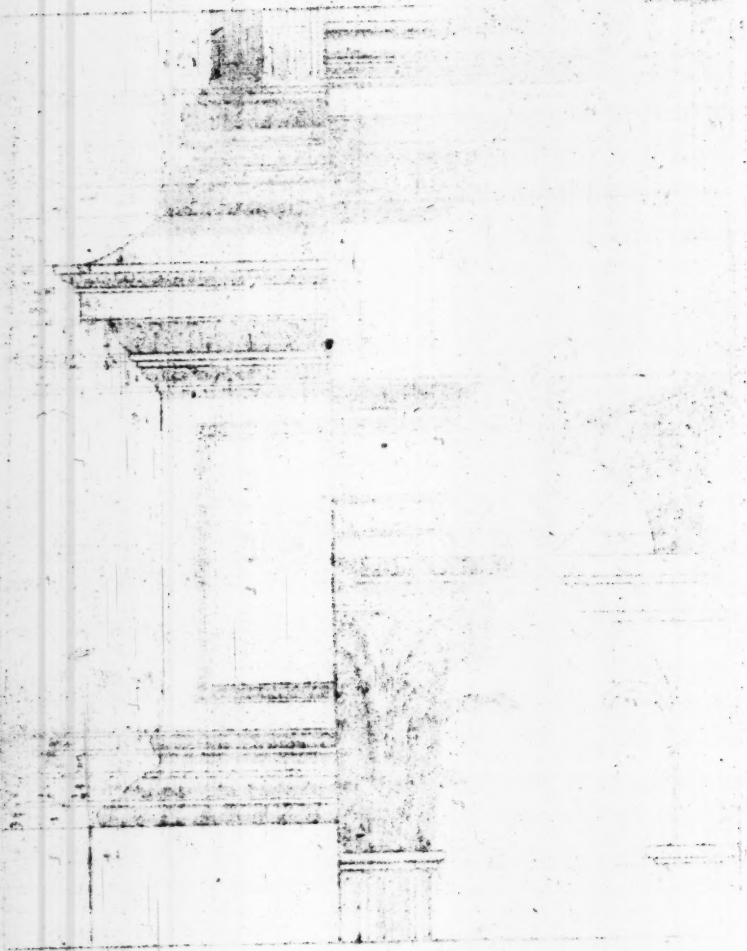


ST. MARK'S CATHEDRAL
HALL

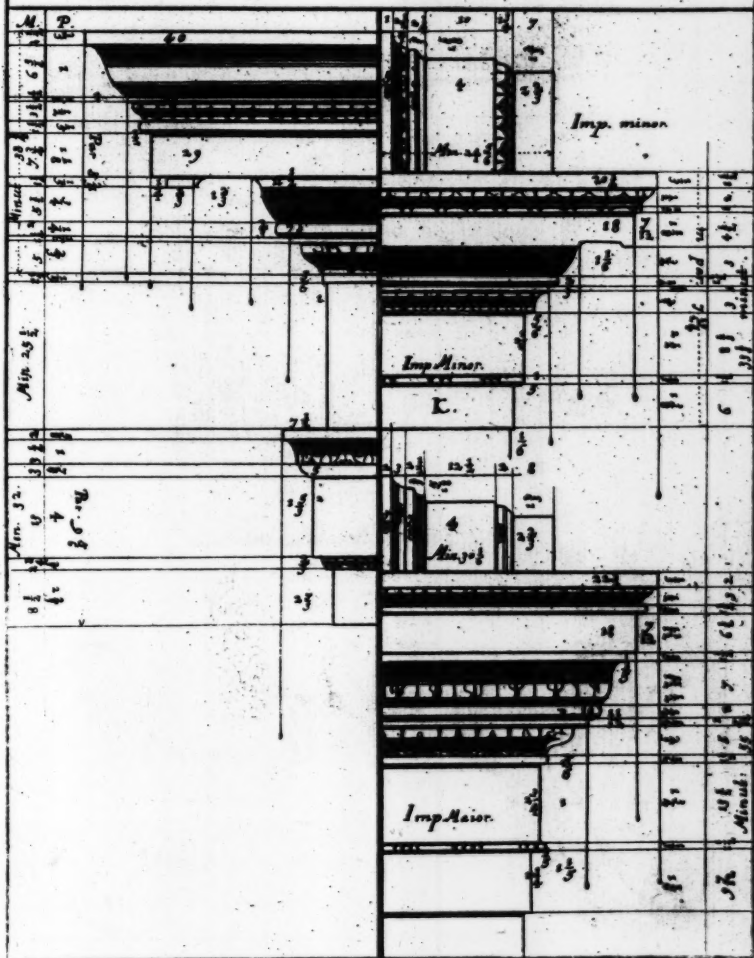


Pedestall Base and Ornament of y.^e 3^o
CORINTHIAN

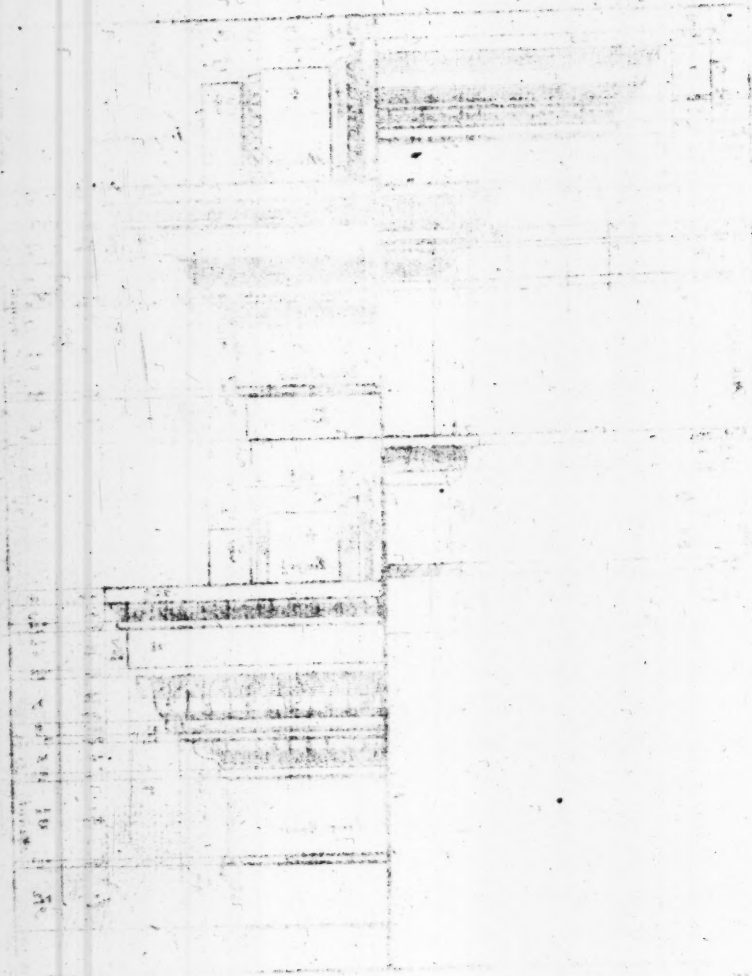




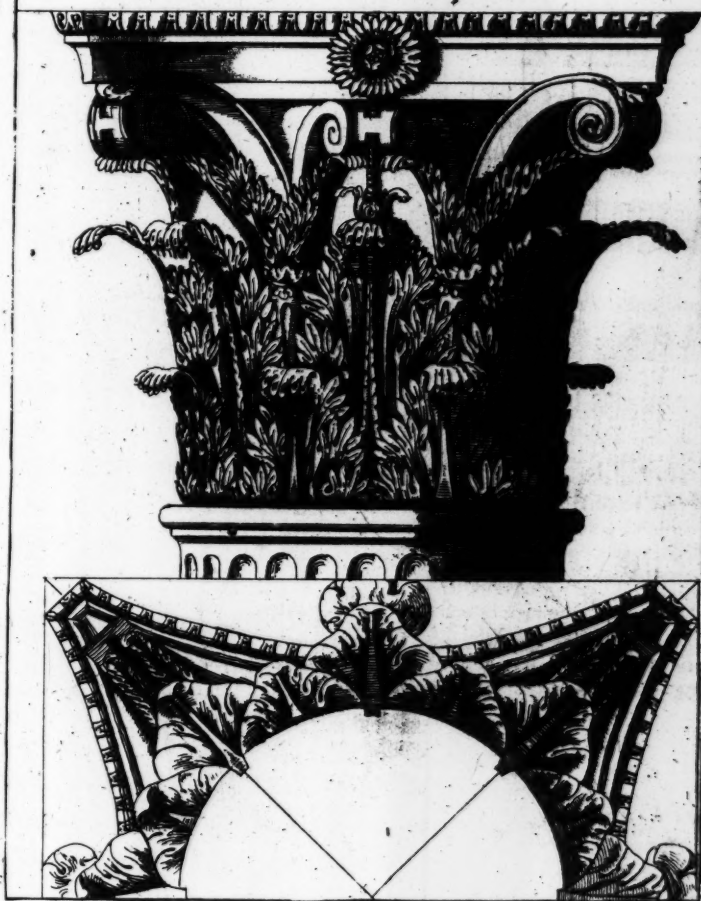
Imposts and Ornament of ³¹ CORINTHIAN

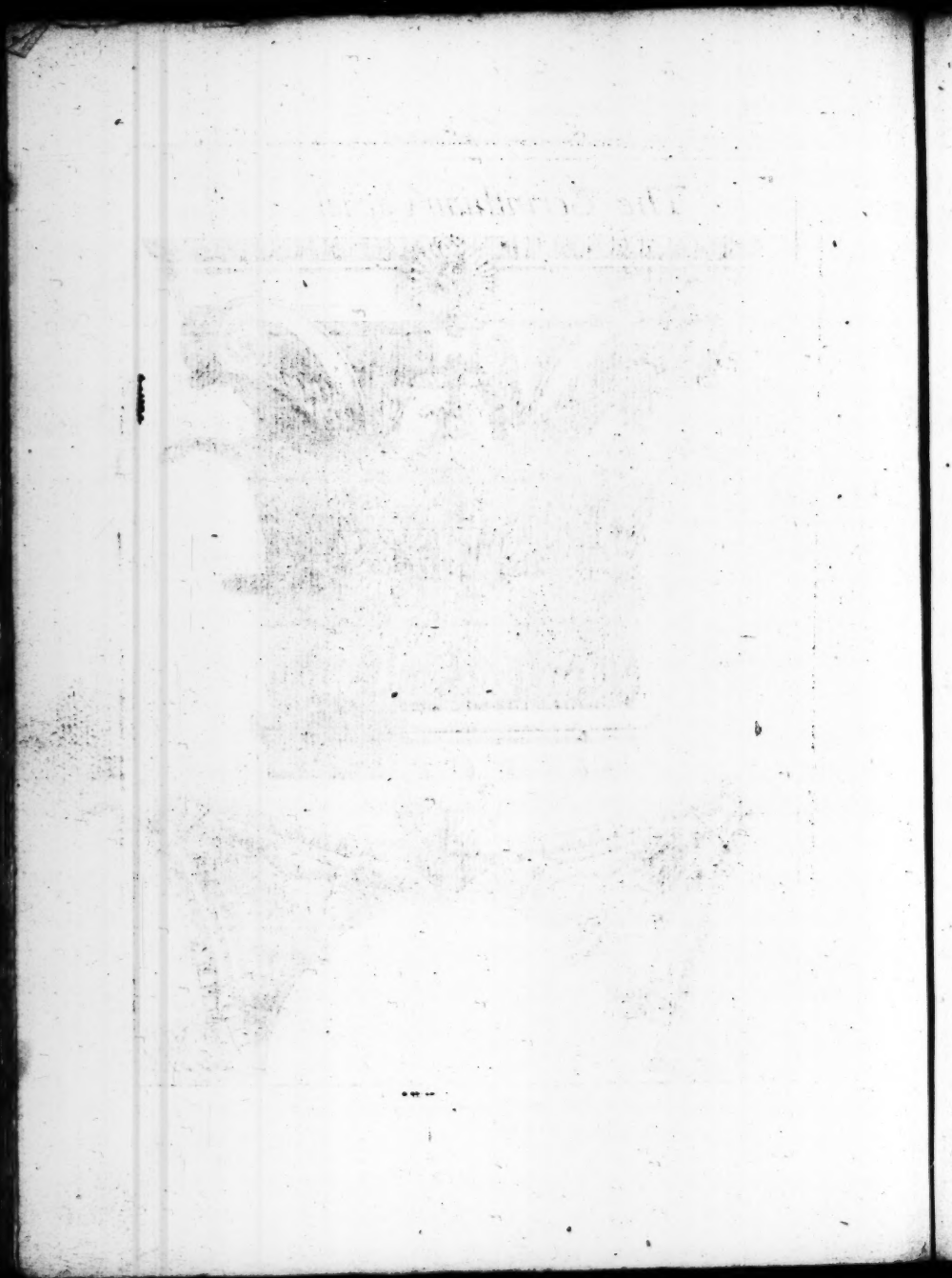


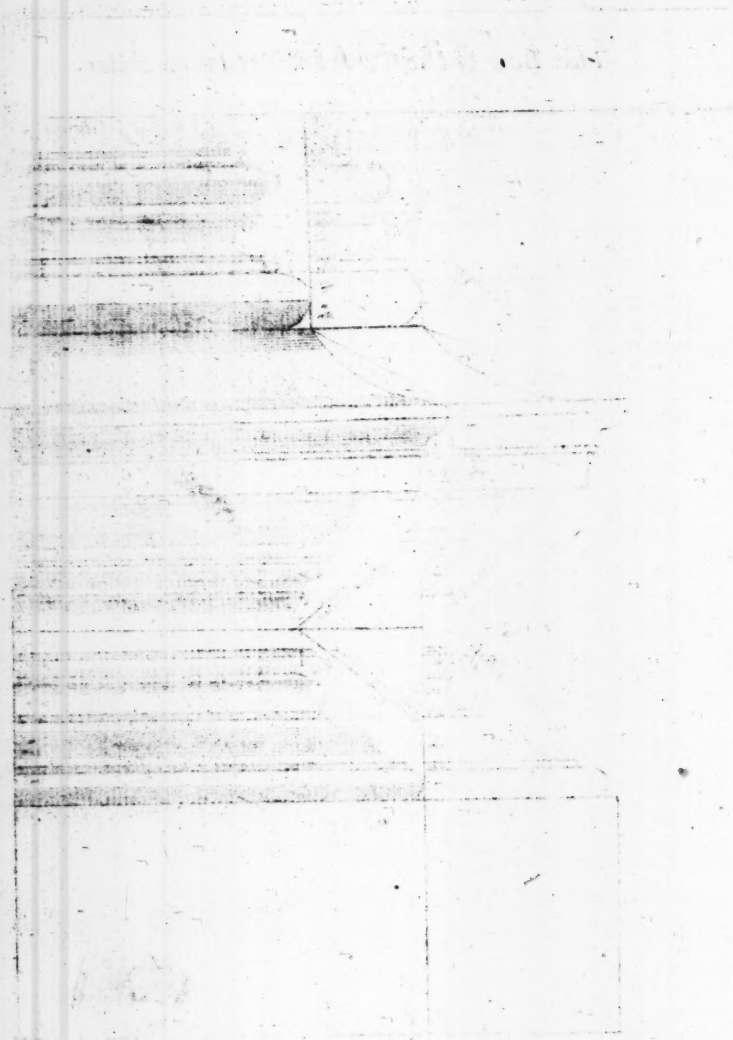
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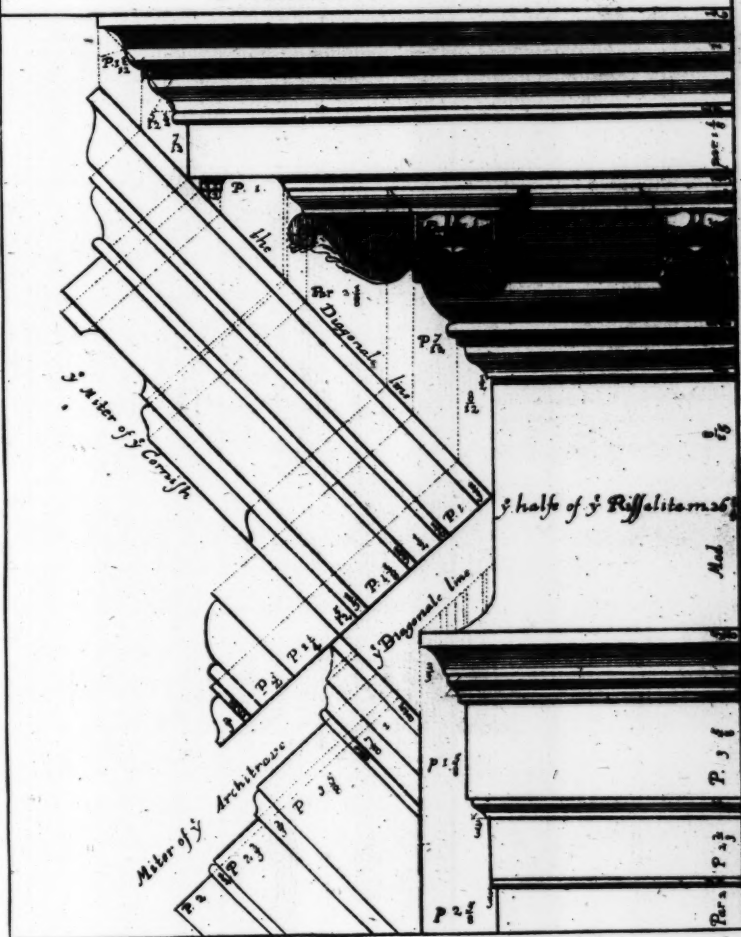
The Corinthian Capital.

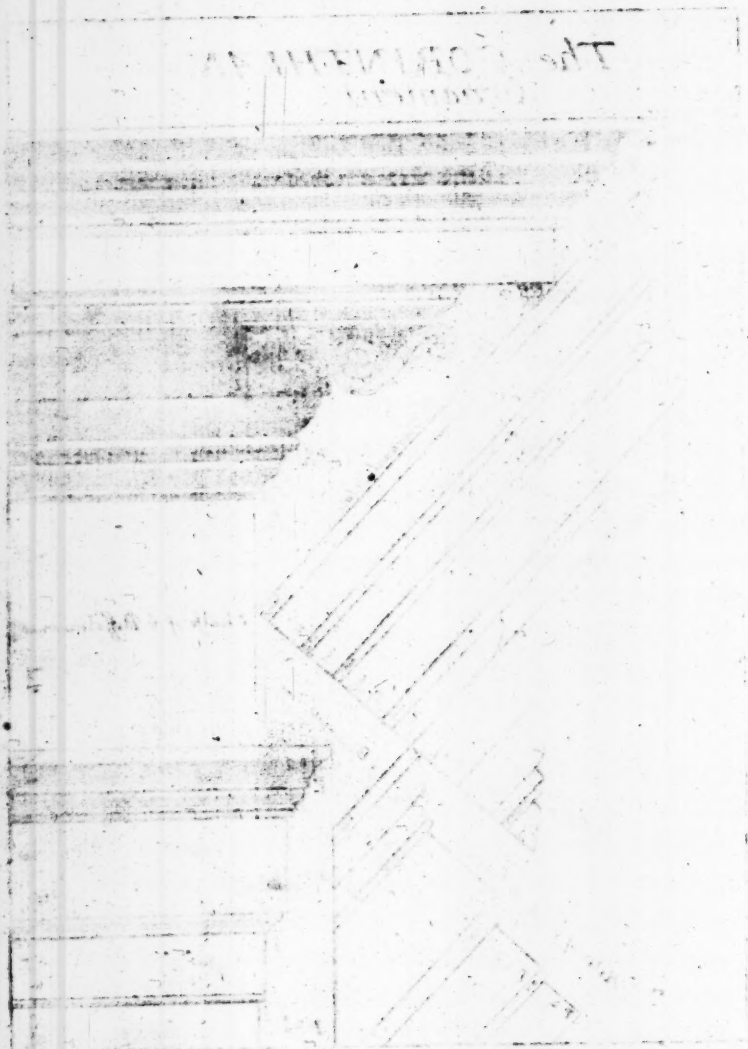




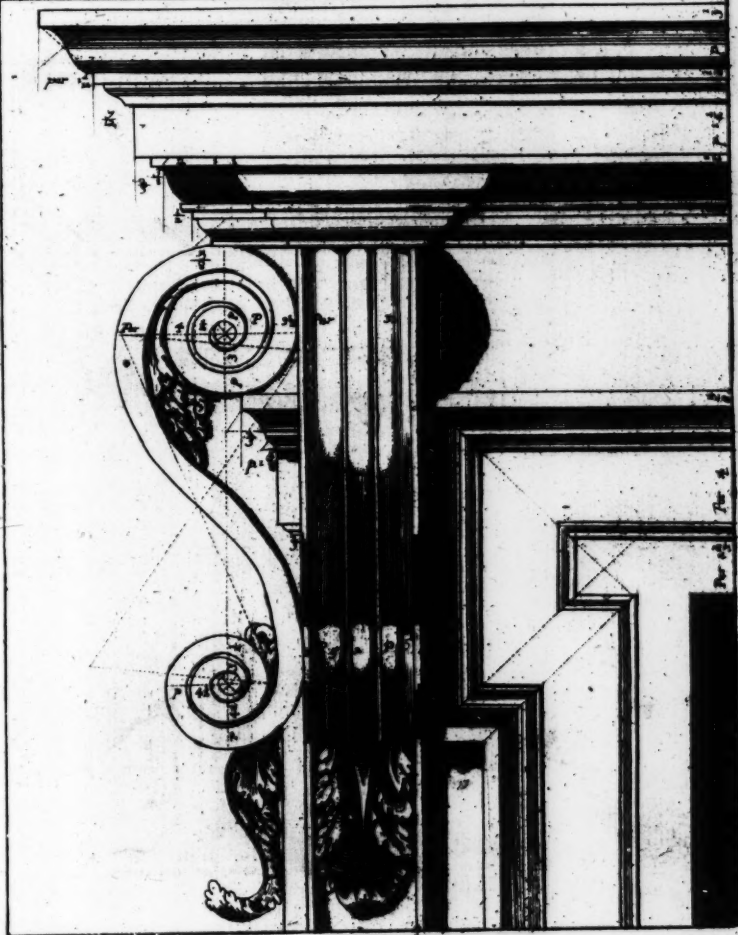


The CORINTHIAN Ornament

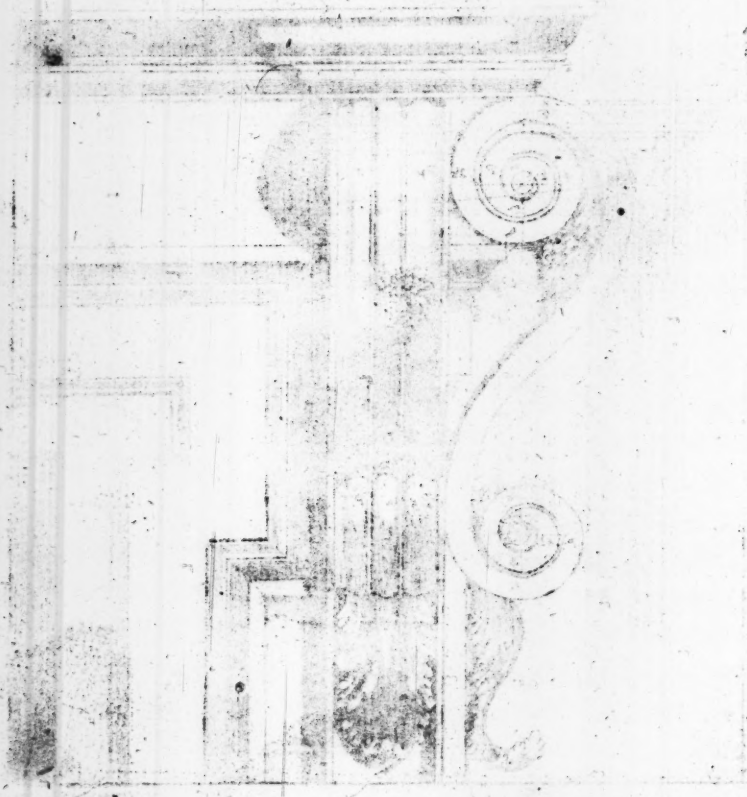




*The Ornament of A CORINTHIAN Doore or
window*



THE UNIVERSITY OF CHICAGO
LIBRARY



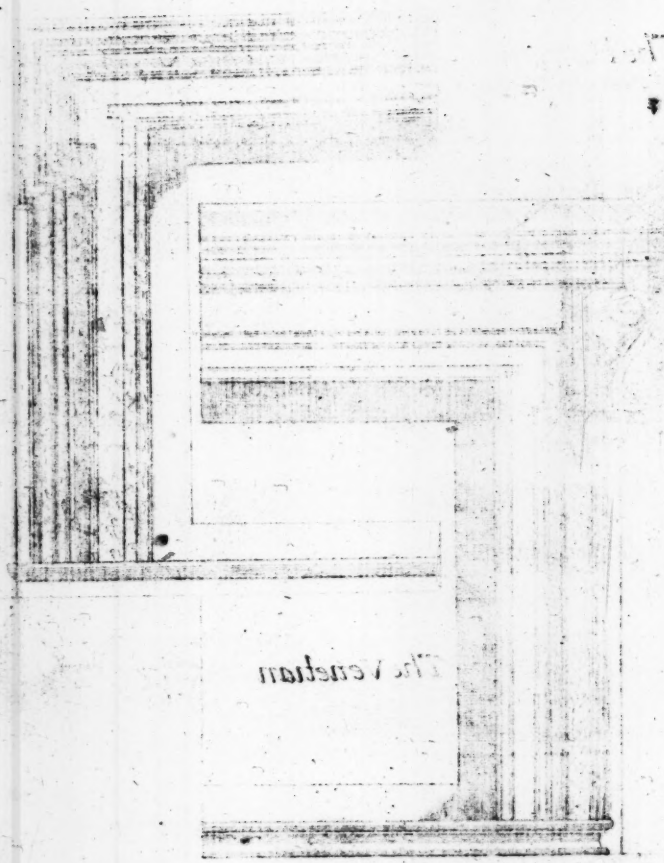
Two Mantle trees for a Chimney:

The Roman



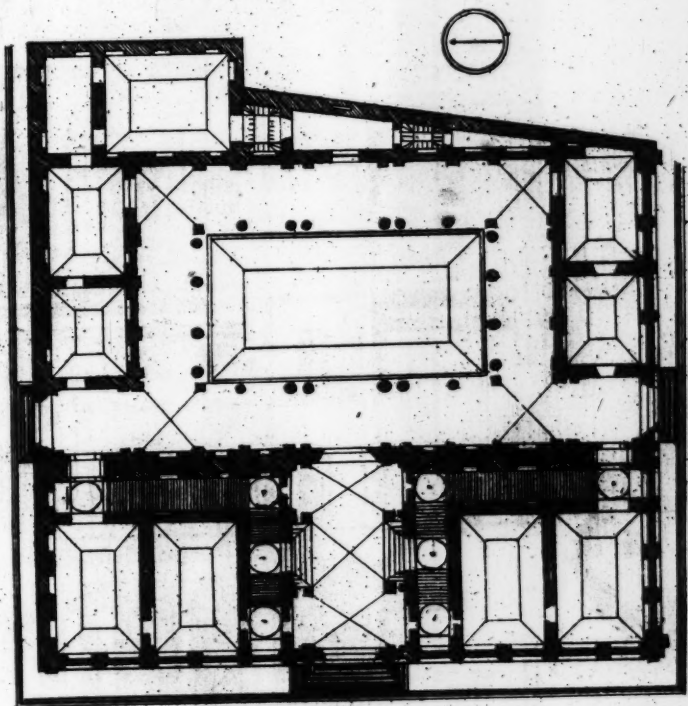
The Venetian

Yerminio 2 1/2 1/2 1/2



The Venetian

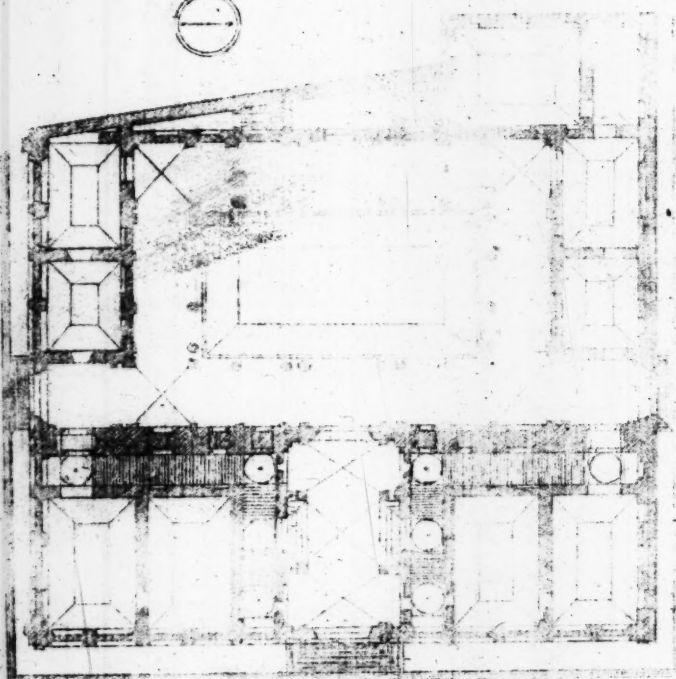
*ŷ Ground platt of my Lord Strozzi house
Standing att Florence*



Feet.

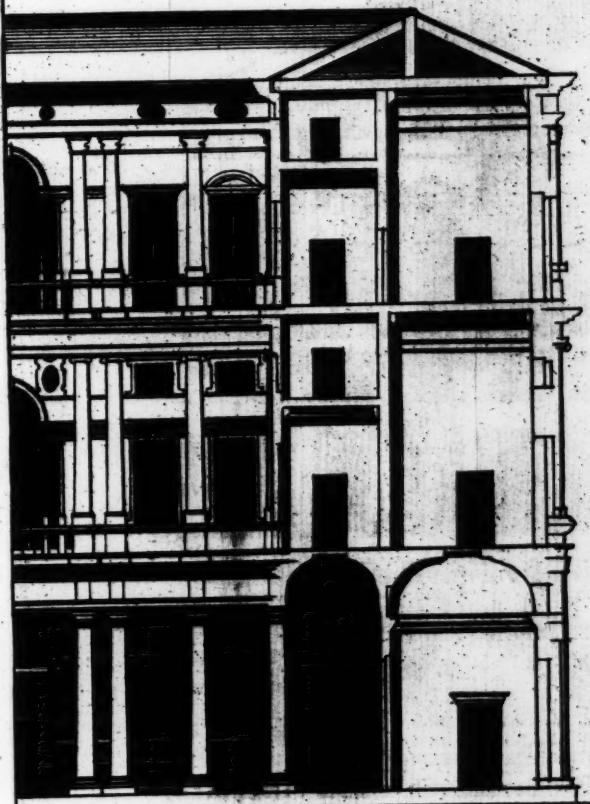
10 20 30 40 50 60 70 80 90 100

Grundriss des Hofes
des Schlosses



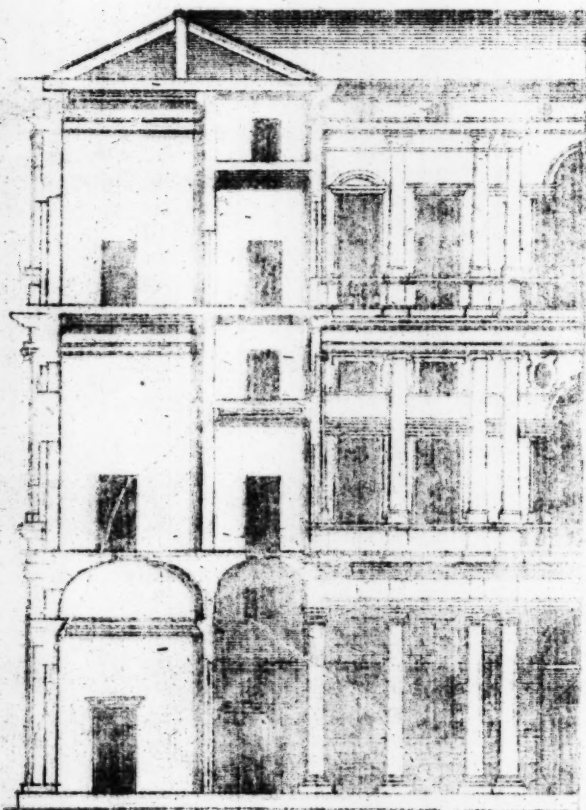
*The Inside of my Lord Strozzi house
standing at Florence*

38



10 20 30 40 50

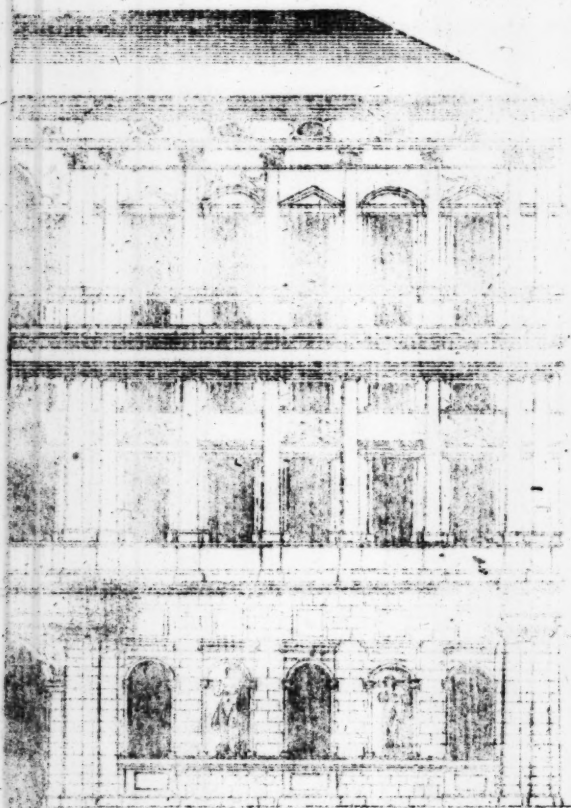
The Perspective and Section of
the Temple of Mars Ultor



The front of my Lord Strozzi house³⁹
standing att Florence



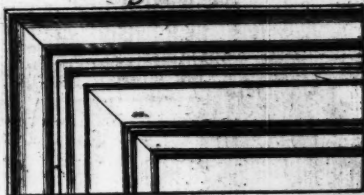
The front of my Lord Stirling's
Mansion in Florence



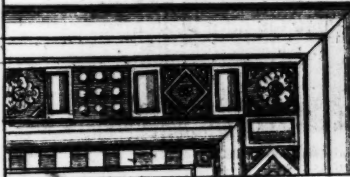
The Vnder side of y^e Cornish

40

Toscana



Dorica



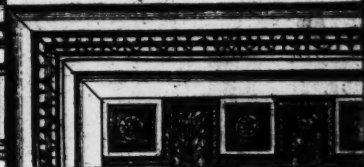
Ionica



Romana



Corintia



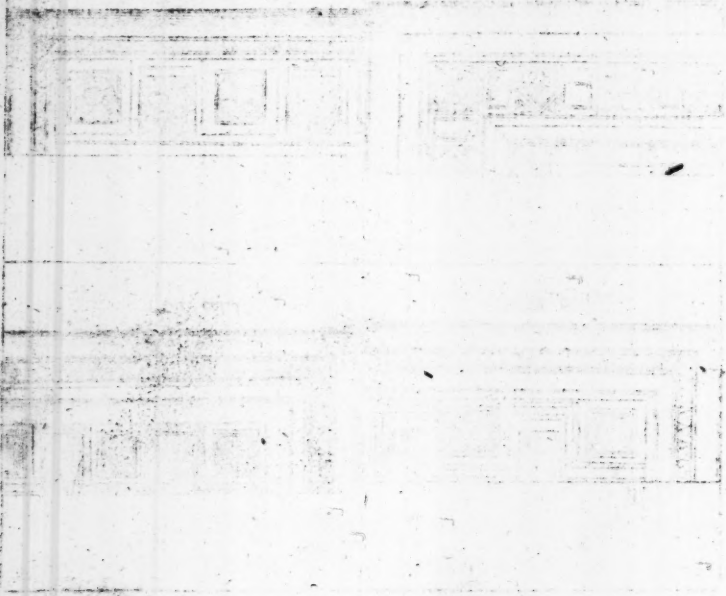
The Antiquities of the Jews

Book I



Temple

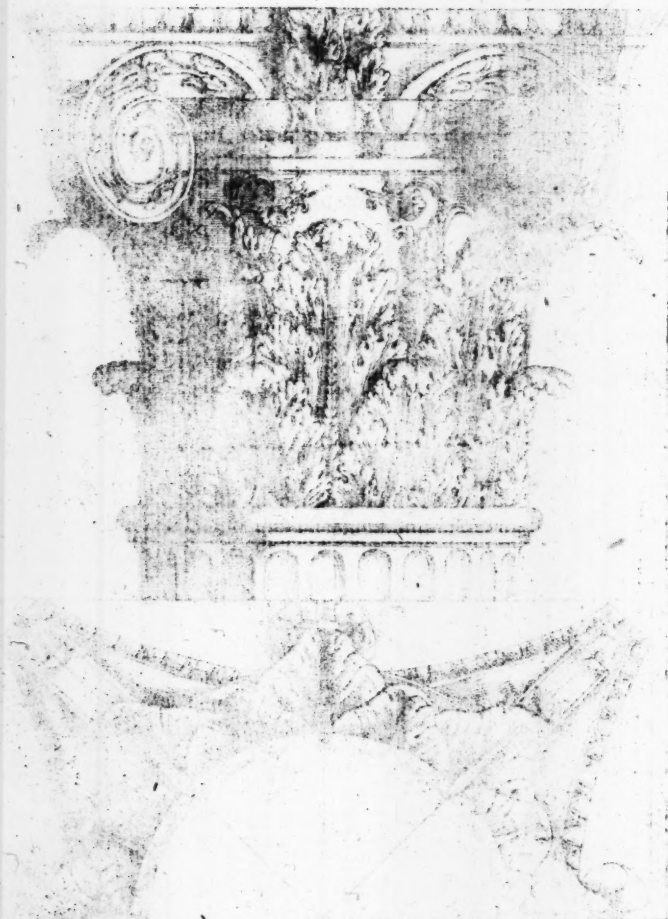
Altar



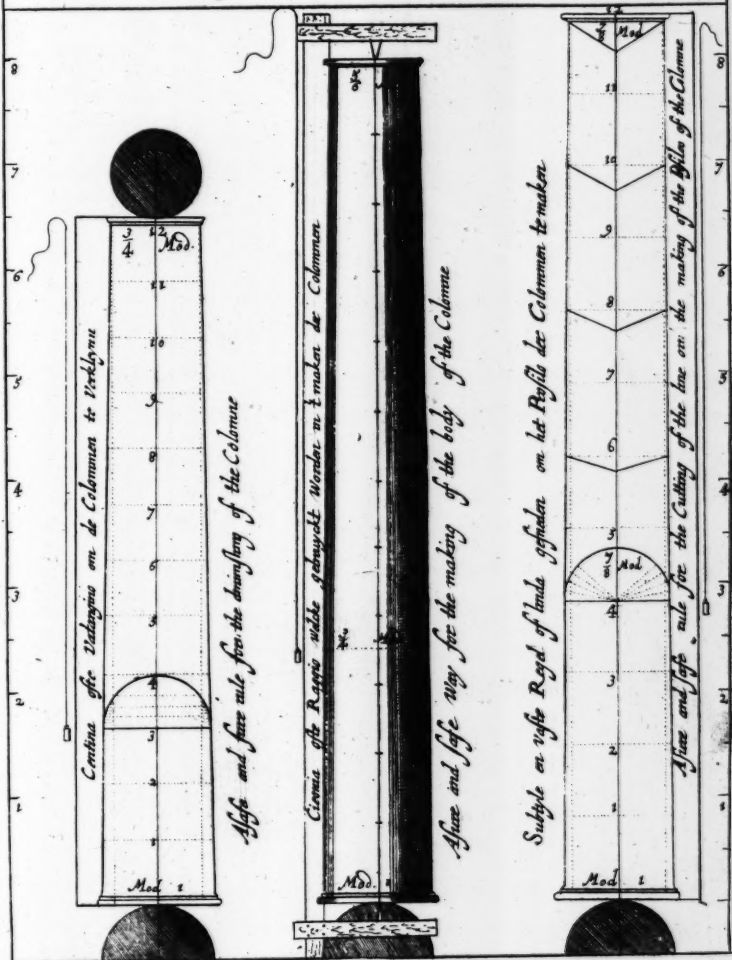
The Roman Capital



The Roman Capital

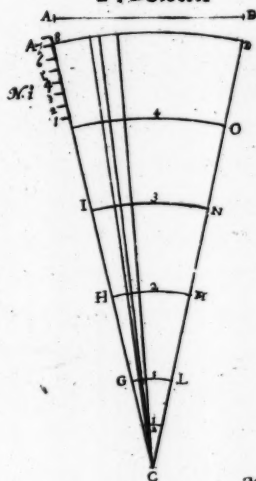


The Diminishing of the Colomnie

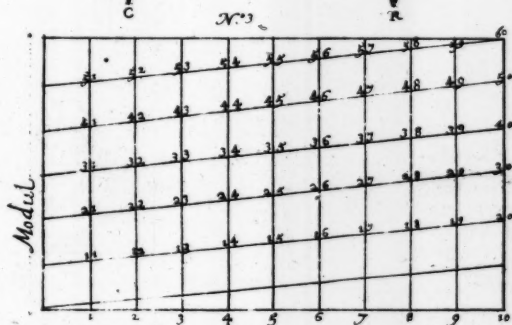
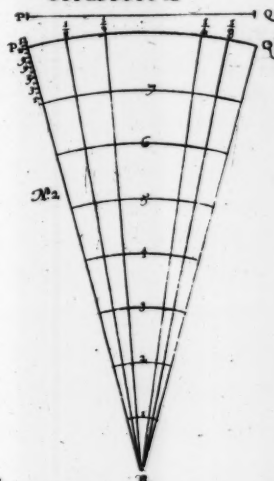




TVSCANA



COMPOSITA



ATLANTA

ALBANY

